THE CITY OF Fitchburg WISCONSIN

Sustainability Plan

April, 2025

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community members providing input

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The planning process started with gathering community input. Key themes from the feedback include:

- Fitchburg Residents support for municipal action and leadership
- Residents want more renewable energy and GHG reductions
- Community members are concerned about climate change
- Natural resource conservation is widely supported

The Plan

Addresses **8 Sectors** of sustainability and resilience

Through **46 Strategies** to achieve goals

Supported by a menu of **193 Actions** outlining steps that can be taken

Over a **6 Year** implementation timeframe

Sustainability Sectors

The plan includes eight sectors focused on sustainability and resilience.
Click on icons to view each section

- Transportation and Land Use
- Buildings and Energy
- Waste Management
- Water and Wastewater
- Local Food and Agriculture
- Greenspace and Ecosystems
- Health and Safety
- Sustainable Economy

The Impact

Successfully implementing the plan will advance 33 sustainability goals and achieve a cumulative reduction of 358,000 metric tons of GHG by 2030 - a 38% reduction in annual GHG emissions.*

This is equal to eliminating 7 Billion Cubic Feet of human-made greenhouse gas atmosphere.

The planned reductions align within science-based greenhouse gas emissions reductions required to limit global warming within 1.5°C to 2°C above pre-industrial levels.[22]

Introduction

Sustainability plans are comprehensive road maps that outline the specific strategies and actions that a community will implement to increase community sustainability.

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GHG Mitigation can avoid 57,000 premature deaths in the United States annually by 2100

- United States Environmental Protection Agency [5]

The City of Fitchburg has a long history of focusing on sustainability, especially since the Fitchburg Common Council adopted the US Mayors Climate Protection Agreement, committing to address climate change. A citizen-led Resource Conservation Commission assists with sustainability goals and initiatives.

Fitchburg has taken significant steps towards becoming a greener community, including installing solar panels on the rooftops of 5 City buildings. The Public Library and both East and West Fire Stations use geothermal heating and cooling systems that significantly reduce energy demands. Additionally, City staff are encouraged to use alternative transportation and the main Civic Campus is designated a Gold Bicycle Friendly Business by the League of American Bicyclists.

Community input strongly supports ongoing sustainable initiatives and climate change efforts, prompting city leaders to create this Sustainability Plan to guide citywide sustainability, resilience and greenhouse gas (GHG) emissions reduction initiatives through 2030.

Co-Benefits of Sustainability Planning

The World Health Organization notes that studies show sustainability policies lead to cost savings and better health. Community actions to eliminate greenhouse gas emissions in housing, transportation, and energy provide more than just climate benefits. They also reduce air pollution, improve health, lower health risks, enhance resource efficiency, support local economic security, and strengthen resilience of ecosystems and built environments[1,2,3,4] Sustainability plan implementation can result in financial benefits, better quality of life, and preserved natural resources.

Financial Benefits

Many sustainability measures lead to financial gains, such as savings from lower fuel use.[6] Additionally, several actions offer indirect financial benefits. Research shows that benefits from reduced air pollution can significantly offset the costs of climate initiatives. Certain measures also support resilience by reducing fossil fuel dependence, avoiding costs of $190 or more per metric ton of greenhouse gas reduction.[7] The biggest financial opportunity may be in health benefits, with global average health co-benefits estimated between $50 and $380 per metric ton of greenhouse gas emissions.[8]

Quality of Life

Sustainability plans help improve the community's quality of life over time. Research suggests that effective climate actions will expand mobility choices, create job opportunities, and reduce poverty and inequality.[9]

Improved Natural Resources

Emphasizing natural resource conservation alongside efforts to curb global warming could mitigate climate change's harmful effects on ecosystems, offering various benefits.[10] Expanding Fitchburg's urban tree cover to align with this plan's goals, for instance, can improve residents' access to green areas and boost the annual economic benefit from the city's trees by up to $116,000.[11]

Climate Change in Wisconsin

Climate change, a global issue, presents significant local challenges. Climate scientists widely agree that the Earth's climate system is destabilizing due to increased greenhouse gas emissions. In Wisconsin, climate shifts have already been experienced: winters are becoming shorter with fewer cold extremes, and heavy precipitation events are more frequent.[12, 13]

Fitchburg's Economic Risk of Climate Change

Future impacts of climate change include effects on agriculture (including food costs), energy costs, labor, mortality rates, and crime, among others. Estimated economic impacts for Fitchburg are:[19,20]

$6,903,000
Annual Cost Impacts (in 2018 dollars)*
* Excludes higher healthcare expenses and increased property damage.

Social Cost of Carbon

"Social Cost of Carbon" measures the future economic harm from one ton of GHG emissions today. For Fitchburg, can be calculated as:[20,21]

Estimated Economic Risk of Climate Change:
$6,903,000
Annual Cost Impact
÷
:Annual GHG Emissions:
419,413
Metric Tons
=
Estimated Localized Social Cost of Carbon:
$16.46*
Per MT GHG

Climate Change Projections for Fitchburg[14]

Over their lifetime, a child in Fitchburg can expect:[14]

Climate Conditions	Baseline	Mid-Century (2050 average)	End of Century (2100 average)
Average Daily Maximum Temperature	56° F	63° F	68° F
Number of Days Per Year > 95° F	1	17	45
Number of Days Per Year < 32° F	158	128	101
Change in Growing, Allergy, and Vector-Borne Disease Season[15]	9 days	27 days	61 days
Average Annual Precipitation and Projected Increases[16]	22.4"	+55%	+67%
Increase in Heavy Precipitation Events[17]	N/A	+30%	+49%
Air Conditioning Demand	500 Cooling Degree Days	+160%	+300%
Estimated Increase In Residential Per Capita Electricity[18]	N/A	+44%	+68%

The Hottest
25 Hottest Years on Record
(Global Avg Temperature)

2024
2023
2016
2020
2019
2017
2015
2022
2018
2021
2014
2010
2005
2013
2007
2009
2012
2006
2002
2003
1998
2011
2008
2001
2004

Fitchburg's GHG Emissions

Measuring, tracking, and reducing GHG emissions are vital for any sustainability planning or implementation. Citywide total emissions for Fitchburg decreased from 446,008 metric tons (MT) in 2014 to 419,413 MT in 2022. This represents a decrease in GHG emissions of almost 6% while the City's population increased over 18% and the city's economy grew almost 4% during the same timeframe.

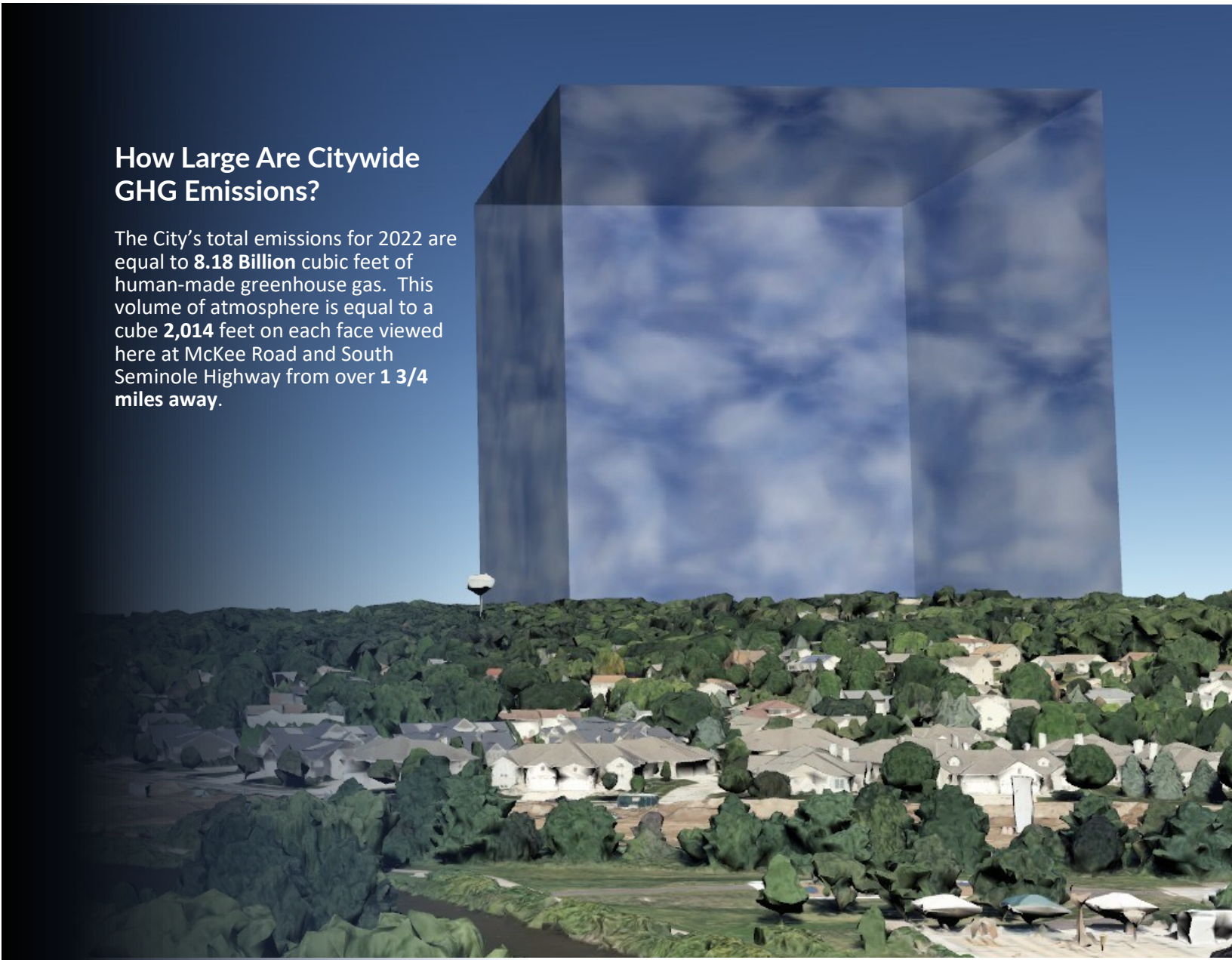
2022 GHG Emissions in Fitchburg by Sector

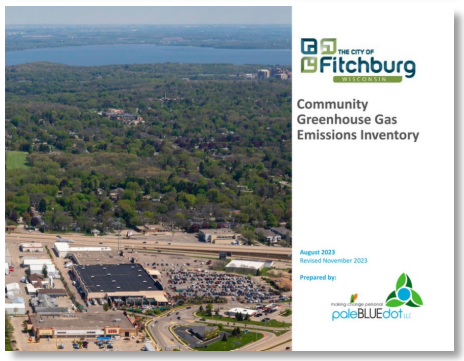
135,049 MT
from transportation

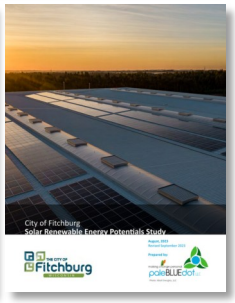
276,436 MT
from building energy

5,168 MT
from solid waste

2,761 MT
water + wastewater







The Process

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30
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2
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580+
community members providing input

The plan was a collaboration involving a 30-person team of community members, business representatives, institutional representatives, City commissions, and City staff. This team was organized into sub-teams for each sector in the plan (see The Plan). Development occurred through workshops from December 2023 to June 2024. The goals and actions in the plan are based on community input, expert analysis, and best practices from other U.S. cities. Strategic goals and actions were developed, refined, prioritized, and finalized by the team through workshop meetings. This process produced a collaboratively created, co-authored Sustainability Plan, integrating voices of Fitchburg residents, businesses, and City staff.

Research Based Sustainability Plan

In support of establishing the goals, strategies, and actions included in this plan, paleBLUEdot also produced a Greenhouse Gas Inventory, a Climate Vulnerability Assessment, a citywide Renewable Energy Potentials Study, a communitywide Ground Cover, Tree Canopy, and Carbon Sequestration Study, and a Sustainability Baseline Assessment. These assessments created the foundation of the planning team process.

Community Engagement

The goal of the Fitchburg Sustainability Plan community engagement effort was to cultivate community co-ownership by engaging them early, at various levels, and facilitating or supporting their participation in decision-making. Engagement included online surveys, community meetings, and planning team participation.

What We Heard

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Finalizing Sustainability Plan Actions

A preliminary draft of actions was reviewed against screening criteria, allowing the Planning Team to evaluate, refine, finalize, and prioritize actions for the final Sustainability Plan. The criteria, established early by the Planning Team, identified overarching values for climate actions. The action screening criteria used were:

Impact of Implementation:
Will it impact a large portion of the targeted emissions sector or population? How likely is it the action will work to address the goal?

Overall Cost to Benefit:
Does this action have a good overall cost-to-benefit potential? Overall cost-to-benefit should include benefits relative to GHG emissions reductions (cost of carbon), and other direct benefits such as operational cost savings or community savings, but also co-benefits such as economic development potential, quality of life potential, health benefits, and avoided costs including avoided costs of "business as usual" impacts if action was not implemented.

Potential for Success:
Do these strategies have a record of accomplishment for success locally or in other communities?

Equity of Implementation:
Will this action positively support advancing equity, or address an existing inequity (such as disproportionate poor air quality, access to transit, flood risk, etc) within the community? Does the action address the needs of vulnerable and historically marginalized populations? Does the action reduce vulnerability for all populations? Is it fair?

Using This Plan

The Strategic Goals outlined in this Sustainability Plan are written to be ambitious, yet achievable, goals for Fitchburg to attain by 2030. Meeting these goals will require partnerships with the community; commitment from Fitchburg's residents, businesses, and other organizations; and further evaluation from City leadership and staff regarding budgeting, staffing, and other resources. The Actions detailed in this plan were determined by the Planning Team to be viable options for the City to meet each of the Strategic Goals, but they are neither a comprehensive set of actions the City could ultimately pursue, nor are all 188 of them expected to be met as written; rather, they serve as a "menu" of potential actions the City could take to achieve goals within, which may be adapted over the coming years as initial goals are achieved and other circumstances evolve.

The plan is organized around eight citywide sectors (see The Plan). Each sector is detailed in a separate section with background considerations. Sectors have overarching strategies for 2030 goals and detailed actions for implementation.

Strategies: specific directions that expand on the sustainability vision and GHG reduction goals, guiding future public policy, community investment, and actions.

Actions: detailed items to complete for carrying out the vision and strategies in the plan.

The Plan

The Fitchburg Sustainability Plan:

Addresses	Through	Supported by a menu of	Over a
8 Sectors	**46 Strategies**	**193 Actions**	**6 Year**
of sustainability and resilience	To achieve goals	Outlining steps that can be taken	Implementation timeframe

Transportation and Land Use Click here for section

Enhancing the resilience of Fitchburg's mobility while reducing environmental impacts of transportation.

Buildings and Energy Click here for section

Enhancing the resilience of Fitchburg's buildings and minimizing impacts by improving efficiency, utilizing renewable energy, and reducing on-site combustion

Waste Management Click here for section

Decreasing environmental impacts and greenhouse gas emissions through enhanced recycling, material re-use, organic waste collection, and overall waste reduction.

Water and Wastewater Click here for section

Reducing impacts of wastewater treatment and water consumption while increasing resilience to flooding and stormwater impacts in Fitchburg.

Local Food and Agriculture Click here for section

Enhancing the resilience of our food systems, improving access to food and ensuring food security, and preserving agricultural land while minimizing their environmental impacts.

Greenspace and Ecosystems Click here for section

Supporting community adaptation through expanded green infrastructure and enhanced ecosystem resilience.

Health and Safety Click here for section

Enhancing community resilience by fostering strong community ties, robust infrastructure, and efficient systems.

Sustainable Economy Click here for section

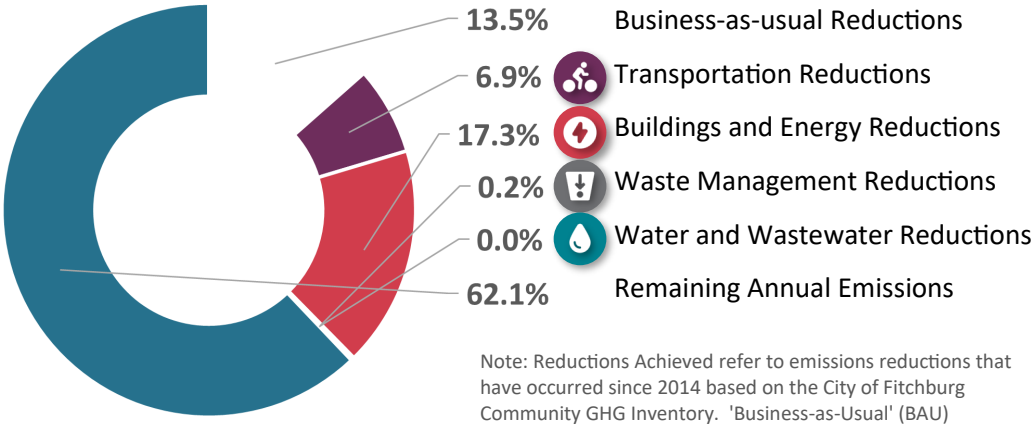
Fostering Fitchburg's economic growth by prioritizing new sustainable enterprises and fair workforce advancement, while increasing resilience and addressing climate change.

Plan Goals

Below are the 2030 plan goals, by sector. See sector chapters for more information.

Plan Impacts:
Estimated Citywide GHG Reductions Included in This Plan

The long-term emission reduction potentials of the strategies and actions in this plan are modeled based on projected energy and fuel reductions and the adoption rates of renewable energy and low/no emission transportation modes. This modeling indicates that successful implementation of the strategies in this Sustainability Plan could reduce citywide annual GHG emissions by 102,438 metric tons below 2022 levels by 2030. The potential cumulative GHG emissions reductions over the six-year implementation period are estimated at over 358,000 metric tons, eliminating over 7 billion cubic feet of human-made greenhouse gases.



Note: Reductions Achieved refer to emissions reductions that have occurred since 2014 based on the City of Fitchburg Community GHG Inventory. 'Business-as-Usual' (BAU) Reductions are anticipated reductions resulting from existing requirements or commitments, such as federal vehicle fuel efficiency standards and electric utility carbon-reduction commitments, which are outside the scope of this plan.

Plan Impacts: Cumulative Economic Savings Potential of Implementing the Plan Through 2030

Transportation Economic Potential:*

Sector Savings:	$53,730,000
Sector Cost Increases:	-$1,980,000

Potential Sector Net Cost Savings:

$51,750,000

Buildings + Energy Economic Potential:*

Sector Savings:	$16,581,000
Sector Cost Increases:	-$11,052,000

Potential Sector Net Cost Savings:

+ $5,529,000

Waste Reduction Economic Potential:*

Residential Savings:	$3,231,000
Commercial Savings:	$718,000

Potential Sector Net Cost Savings:

+ $3,949,000

Social Cost of Avoided Carbon:*

+ $5,900,000

Estimated Localized Social Cost of Carbon:

Cumulative Community Savings Potential:*

= $67,128,000

* Estimated community-wide costs and savings are calculated based achieving goal statements and are not calculated on an individual action basis. Values do not include economic potential of job creation and new business potential represented in the plan actions. See Appendix B for a detailed illustration of how cumulative costs and savings are arrived at.

Transportation and Land Use

Enhancing the resilience of Fitchburg's mobility while reducing environmental impacts of transportation.

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Sector Goals

by 2030:

48.4% drop in GHG emissions from 2022

5% fewer vehicle miles traveled

1.5x increase in public transit use

15% registered electric vehicles citywide

3% increase in population density

What We Heard:

76%
of survey respondents support changes in city development rules to favor walkable neighborhoods and business districts.

Equity Considerations:

Ensuring equity in transportation initiatives means fairly distributing the costs, benefits, and burdens of increasing sustainability in this sector. Marginalized communities are often disproportionately impacted. Important equity considerations include:

Access: Providing fair access to affordable, reliable, and sustainable transportation choices, enhancing public transit, expanding bike lanes, and addressing transportation gaps in underserved areas.

Affordability: Reducing financial obstacles by offering incentives, subsidies, and financing options for low-income individuals to transition to sustainable, low-carbon transportation.

Jobs: Ensuring transportation-related workers receive training, employment opportunities, and equitable wages throughout the shift to a sustainable economy.

Transporting ourselves and our goods is highly energy intensive, and the vehicles used are very resource-intensive. Besides transportation vehicles, off-road equipment like construction, recreational, and lawn equipment also consume significant fossil fuels. Off-road equipment emits higher greenhouse gases and overall air pollution per gallon of fuel consumed compared to on-road vehicles due to less efficient combustion and lower emission standards.[1]

Globally, equipment and transport systems contribute significantly to environmental impacts, responsible for 20% to 25% of the world's energy consumption and carbon dioxide emissions.[2] In the City of Fitchburg, the transportation and land use sector accounts for 32.2% of Citywide GHG emissions.[3] Although Vehicle Miles Traveled (VMT) are expected to rise without intervention, transportation emissions may decline as the sector shifts from fossil fuels to electricity and as the electricity sector adopts more renewable energy sources.[4]

There are a number of ways to enhance the sustainability of our transportation systems while also improving quality of life and equity. Promoting shared transportation and reducing single-occupancy vehicle use can significantly lessen transportation's environmental impact. Additionally, alternative modes of transportation such as bicycles, eBikes, and scooters not only decrease air pollution but also provide more opportunities for exercise. Transitioning to electric vehicles and adopting renewable fuels can help decarbonize transportation systems and enhance air quality, even in lower-income neighborhoods with lower rates of EV ownership.[5, 6]

Strategies on the following pages show how we achieve our sustainability goals for Transportation and Land Use.

Actions shown for each strategy outline steps the City and community can take to support the plan goals.

Strategy Metrics indicate how we can measure our progress on each strategy.

Strategy TL 1

Decrease total community wide Vehicle Miles Traveled (VMT) by 5% by 2030.

Community-wide vehicle miles traveled (VMT) in Fitchburg was 265.3 million miles in 2022. Although the city has seen a 6.9% increase in total VMT since 2014, VMT per household has decreased 15.3%.[3]

Decreasing total city-wide vehicle miles by 5% will decrease vehicle miles traveled by more than 13 million miles and reduce city-wide GHG emissions by over 6,700 metric tons annually. Increasing availability and safety of bike and walking routes to schools, retail hub, and recreation centers can support reduced vehicle use for other types of daily trips.[7]

Strategy Metrics:

Reported “drive alone” commuter transportation data (US Census);
Annual VMT data reported (WIDOT)

ACTIONS

TL 1-1	Establish a Complete Streets policy to guide the planning, designing, building, operating, maintaining, and funding of streets to enable safe access for all people including pedestrians, bicyclists, motorists and transit riders of all ages and abilities. Source funding to implement policy and establish review criteria for City transportation and infrastructure projects to ensure alignment with policy.
TL 1-2	Partner with the school districts in Fitchburg to develop a Safe Routes To Schools Implementation Plan (SRTS) for all schools within the City and include as an update to the city's Bicycle and Pedestrian Plan. Plan implementation should focus on infrastructure and policy changes as well as education and encouragement.
TL 1-3	In accordance with the Fitchburg Bicycle & Pedestrian Plan, improve and maintain Fitchburg's bike and pedestrian infrastructure, to ensure a safe network of sidewalks, paths, and trails that encourage and support biking and walking.
TL 1-4	Install universal design accessibility features at crossing locations to ensure the crossing is accessible for everyone (e.g., raised crossings, pedestrian traffic signals, audible signals). Install audible signals at all signalized intersections when signals are replaced or added in the future.
TL 1-5	Prioritize building sidewalks, crosswalks, and other walking infrastructure in high need areas and those identified in the city's Bicycle and Pedestrian plan.
TL 1-6	Promote incentives for employers to provide transit passes, bicycle racks, bicycle sharing stations, carpool parking, shuttle services, and pedestrian facilities. Implementation should be prioritized for improved equity.
TL 1-7	Make a brochure that can be used by landlords to give info to their residents to assure developers and apartment owners help residents know about park locations, bike/walk/transit info, sustainability goals and resources, trash and recycling opportunities, renewable energy options, incentives, etc. Brochure should link to the most up-to-date information maintained on the City website.

Strategy TL 2

Increase public transit commuter ridership from 1.3% to 3.3% by 2030.

The average commute in the city is 20.5 minutes, or approximately 15 to 20 miles.[8] Of the nearly 12,500 jobs in the city, over 11,500 are filled by employees who live outside of the city.[9] Meanwhile, AAA estimates that the cost per mile for operating a vehicle is $0.81.[10] Consequently, every 1% increase in commuter utilization of public transit in the city may decrease vehicle miles traveled by 1.1 million miles, saving an estimated $915,000 and eliminating 575 metric tons of GHG emissions annually.

Strategy Metrics:

Reported public transit commuter data (US Census, Madison Metro Transit, AllTransit)

ACTIONS

TL 2-1	Improve efficiency, convenience and reliability of bus service and infrastructure (e.g., increase frequency, shorten wait times, construct bus stop shelters)
TL 2-2	Preserve and enhance affordable housing, especially near bus service, to prevent displacement of vulnerable populations. Collaborate with Madison Metro Transit to preserve and promote development of public transit routes serving affordable housing and vulnerable populations within Fitchburg.
TL 2-3	Partner with Madison Metro Transit to expand access to transit including expansion of Bus Rapid Transit routes, income qualified fare reductions, or other strategies.

Strategy TL 3

Increase average population per developed acre in the urban service area by 3% by 2030.*

* from 4.5 to 4.64 ppl/acre

The City has around 6,900 acres of developed land, comprising approximately 33% of its total area, supporting about 30,834 people, averaging 4.5 residents per developed acre.[11] Fitchburg's comprehensive plan forecasts a population of over 35,000 by 2030 and 41,000 by 2040.

Research indicates that with every 1% increase in community density, GHG emissions from household travel decrease by 0.48%, and those from residential energy use decrease by 0.35%.[12, 13] Consequently, directing the city's growth towards existing developed land can reduce emissions per household across the city.

Strategy Metrics:

Reported developed acreage (US Census, City of Fitchburg data),
Reported population (US Census)

ACTIONS

TL 3-1	Amend the zoning ordinance to allow higher density walkable, connected neighborhood development. These amendments should include increasing building heights, allowing projects to build out to approved densities, allow and encourage Accessory Dwelling Units (ADU), and should consider opportunities for mixed land use. Increased density can minimize vehicle miles travelled.
TL 3-2	Explore incentives for infill and mixed-use development close to neighborhoods to provide walkable destinations for daily needs. Incentives may include alternative code compliance, fee waivers, density bonuses, investment prioritization, development impact fees, etc.
TL 3-3	Establish a method for projecting the lifecycle carbon emissions of land use and transportation investments associated with the City's City's Transit Plan and Comprehensive Plan, including consideration of embodied energy, operations and maintenance. (see City of Eau Claire WI Land Use Carbon Calculator).

Strategy TL 4

Increase battery electric vehicle (BEV) and PHEV use to 15% of vehicles on the road by 2030.*

* from approximately 206 vehicles to 3,166 vehicles community-wide

Switching vehicles from fossil fuels to low/no emission options citywide is necessary for long-term GHG emission reductions. Research shows EVs can slash emissions by 50-70%, with battery production emissions offset in 2 years.[14]

The fate of EV batteries post-use is a common sustainability concern. Current recycling methods are now capable of reclaiming over 95% of materials, with 80% fewer emissions compared to manufacturing anew, reducing the environmental breakeven point with gasoline vehicles to under 15,000 miles.[15] Recent battery recycling advancements have even been shown to produce EV batteries that outperform those from raw materials.[16]

Fitchburg has about 21,100 vehicles.[17] Shifting from fossil fuels to low/no emission alternatives is essential for long-term emissions reductions. As of August 2023, 206 battery electric vehicles (BEVs) were registered in Fitchburg.[18] Each 1% increase in EVs can eliminate over 1,000 metric tons of GHG emissions annually, even accounting for increased electricity use.

Strategy Metrics:

Registered EV vehicles city-wide (State of Wisconsin, EVAtlasHub https://www.atlasevhub.com)

ACTIONS

TL 4- 1	Create a citywide EV Roadmap. Plan should create a citywide and city facility electric vehicle (EV) charging station study and masterplan to map existing infrastructure, determine the current and future demand for EV charging stations, and to identify options for increasing number of electric charging stations in public parking areas (e.g., schools, parks, libraries, City-owned parking garages, near City Hall), options to serve households living in multi-family properties, and in commercial and high-density residential areas. Plan should explore EV charging technology options such as utility pole mounted charging and induction charging. Plan should include implementation strategies to meet citywide EV charging demand and promote adoption of EVs withing the community.
TL 4- 2	Collaborate with MGE in piloting utility pole electric vehicle charging in Fitchburg. Guide pilot charging locations based on the Dane County EV Plan, with a prioritization for sites that support EV ownership for residents living in multi-family housing.
TL 4- 3	Identify an existing or create an “EV Ready Building Guide” then distribute, and promote its use.
TL 4- 4	Collaboratively expand regional electric vehicle (EV) charging infrastructure and promote existing initiatives of partners like Madison Metropolitan Planning Organization.
TL 4- 5	Encourage installation of electric vehicle charging capacity in single family and multifamily residences and commercial projects by providing information on appropriate conduit and electrical panel considerations as a part of permit application process. Collaborate with electric utility to develop and provide information on utility, local, State, and Federal incentives supporting EV infrastructure.
TL 4- 6	Develop employee EV commuting pilot program to incentivize sustainable local commutes to and from Fitchburg.
TL 4- 7	Develop an incentive program to convert fuel-burning lawn equipment such as gas-powered lawn mowers and blowers to electric. Incentive should focus on increasing community equity. Work with electric utility on creation and promotion of incentives.

Strategy TL 5

Support adoption of renewable fuels and infrastructure expansion. Achieve 20% diesel consumption replacement by 2030.*

* Renewable fuels include hydrogen, renewable diesel, and bio diesel

Transitioning to electric vehicles is a key climate solution, but it's challenging for some specialized diesel-powered equipment due to performance and infrastructure issues. Immediate alternatives are crucial for fast emission reductions.

Biodiesel, derived from organic materials, can reduce emissions by over 70% compared to conventional diesel.[19] Renewable diesel (or E-Diesel), produced using green electricity, can be considered carbon neutral and serves as a method for storing surplus renewable energy.[20]

Strategy Metrics:

GHG Inventory Updates,
City reported renewable/ biodiesel use;
City reported conventional diesel use

ACTIONS

TL 5- 1	Conduct a No/Low Emission Diesel Vehicle Fuel Alternative Feasibility Study to identify viable no/low diesel vehicle fuel alternatives, sources, and outlets for increasing no/low emission fuel alternative availability and utilization. Study to include analysis of efficiency chain and impact on land use and other communities. Study may include exploration of existing supply chains as well as potential new sources such as through a locally operated biodiesel plant or plasma gasification plant producing hydrogen or biodiesel.
TL 5- 2	Collaborate with partners to identify pathways to provide alternative fuels. The City could work with owners of larger fleets in the City, City of Madison, Dane County, the State of Wisconsin, or others to identify opportunities to increase use of alternative fuels, including availability of alternative fuels serving the public. Improving accessibility to fueling stations could persuade consumers who are worried about refueling limitations to make the switch to alternative fuel vehicles.
TL 5- 3	Collaborate with partners, such as the Midwest Alliance for Clean Hydrogen and other potential partners identified on the US Department of Energy's H2Matchmaker, to develop a pilot project based on findings of the No/ Low Emission Diesel Vehicle Fuel Alternative Feasibility Study, to assess opportunities for region wide adoption or production of hydrogen fuel.
TL 5- 4	Establish communication and education campaign to encourage the use of low emission vehicles unable to be replaced with electric alternatives.

Strategy TL 6

Achieve 40% conversion of municipal operations gasoline vehicles and equipment within City and municipal fleets to EV's by 2036. Achieve 100% conversion by 2048.

Local governments can spearhead the shift to electric vehicles (EVs), highlighting sustainable transportation's benefits and practicality. By converting Fitchburg's fleet to EVs, the City can greatly lower its operational carbon footprint, establish itself as a sustainability leader, enhance community awareness and acceptance of electric mobility, and reduce long-term fleet maintenance and operational costs.

In 2022, the City of Fitchburg municipal vehicle fleet consumed a total of 51,944 gallons of gasoline - just over 62% of the total fleet fuels consumed. Converting 40% of the municipal gasoline vehicle fleet to EVs will reduce municipal GHG emissions by as much as 180 MT annually (including emissions associated with increased electricity consumption).[3, 21]

Strategy Metrics:

City reported total vehicle fleet count and EV vehicle count

ACTIONS

TL 6- 1	Conduct an Electric Vehicle Suitability Assessment (EVSA) for vehicle fleet. The EVSA should include fleet vehicle use case identification and operational monitoring resulting in determination of viable alternative fuel vehicle options for near, mid, and long term replacement. EVSA should include an overview of "EV Ready" strategies to support conversion of the vehicle fleet and equipment to EV, establish a charging station implementation plan for city facilities, and identification of fleet purchase options, funding, and incentives. Plan should also include exploration of solar powered EV charging for city fleets.
TL 6- 2	Require a proportion of non-emergency City fleet vehicles to be electric vehicles, or use no/low carbon alternative fuels, based on the results of the EVSA (above). Update City vehicle purchasing policy/budget process to default to alternative fuel with traditional internal combustion engine (ICE) as optional requiring proof of need. Policy to take emissions/fuel reductions into account when purchasing vehicles/equipment.

Strategy TL 7

Convert all municipal operations diesel fuel utilization to renewable diesel and/or biodiesel fuel, or other low/zero emission alternative fuels by 2035.

Similar to electric vehicle adoption, local governments can guide the shift from fossil fuels to lower-emission renewable fuels, demonstrating the advantages and feasibility of sustainable transportation while fostering a viable market for these fuels within the community.

Strategy Metrics:

GHG Inventory Updates;
City reported renewable/ biodiesel use;
City reported conventional diesel use

ACTIONS

TL 7- 1	Establish a Diesel Free Transition Plan (DFTP) for diesel equipment in the city's vehicle and equipment fleets. The DFTP should include fleet vehicle use case identification and operational monitoring resulting in determination of viable alternative fuel supply chain and vehicle options for near, mid, and long term replacement. Alternatives explored should include hydrogen, renewable diesel produced through renewable energy and electrolysis plant, renewable natural gas, and biodiesel. The DFTP should include an overview of "Diesel Free Ready" strategies to support conversion of the diesel vehicle fleet and equipment to alternatives, establish an infrastructure implementation plan for facilities, and identification of group purchase options, funding, and incentives such as grants from the US EPA and other agencies in support of the Diesel Emissions Reductions Act (DERA).

Strategy TL 8

Increase fuel efficiency of remaining internal combustion engine fleet by 5% by 2030.

Improving vehicle fuel efficiency is crucial for lowering fleet emissions. This can be accomplished through efficient driving habits, regular maintenance, and using high-efficiency components. Eco-driving alone can cut fuel use by at least 10%.[22] As vehicles are upgraded, those not yet replaceable with EVs should be substituted with hybrids (HEVs) to cut fuel consumption by 20-25%, or plug-in hybrids (PHEVs) which can reduce it by up to 60%.[23, 24, 25]

Strategy Metrics:

City GHG updates;
City reported passenger vehicle fleet fuel consumption;
City reported fleet vehicle average MPG;
City reported vehicle share by fuel type

ACTIONS

TL 8- 1	Work with vehicle partners to identify fuel-efficient ICE vehicle options achieving a minimum 5% increase in fuel efficiency by 2030 where EVs are not available or appropriate.
TL 8- 2	Support improved fuel efficiency by compiling an "Eco Driving Guide" to distribute to all employees and include in new employee training. Make Eco Driving Guide available to Fitchburg residents and businesses.

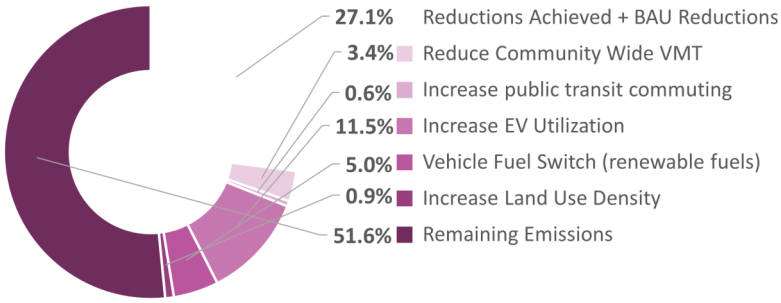
Planned Sector Emission Reductions Through 2030

The strategies and actions included in this section of the Sustainability Plan are projected to reduce the city's annual GHG emissions by 28,851 metric tons (MT) annually by 2030. In addition a reduction of 36,547 MT of "business-as-usual" emissions reductions are anticipated. The result is a total citywide Transportation and Land Use sector reduction of 48.4% below 2022 levels.

When compared to 2022 emissions, this is equivalent to eliminating over 10,200 of the city's current vehicles from the road, or **1.28 billion** cubic feet of human-made GHG atmosphere annually by 2030.

Sector Emissions Reduction below 2022 by 2030

The total change to sector emissions include plan reductions and business-as-usual (BAU) emission changes as follows:



Note: Reductions Achieved refer to emissions reductions that have occurred since 2014 based on the City of Fitchburg Community GHG Inventory. 'Business-as-Usual' (BAU) Reductions are anticipated reductions resulting from existing requirements or commitments, such as federal vehicle fuel efficiency standards and electric utility carbon-reduction commitments, which are outside the scope of this plan.

What You Can Do

You can support the goals of the Transportation and Land Use section of this Sustainability Plan as an individual, household, or a business. Here are just a few things you can do:

Reduce car use

- Walk or bike when traveling short distances.
- Take public transit to work or to run errands. Plan your trips here.
- If possible, telecommute or carpool to avoid transportation emissions.
- Consider becoming a one-car household - and save thousands of dollars annually. Explore how to make the change here.

Reduce your ride's impact

- Keep your personal vehicle well-tuned and tires inflated properly, saving up to 20% in gasoline use.
- Don't idle your car – even in the winter. The best way to warm up your car in the winter time is by driving it. No more than 30 seconds of warm-up is needed.
- Drive an electric, plug-in hybrid or low-emission vehicle. Explore incentives here and here.

Reduce lawn equipment impact

- Replace your grass lawn and plant native pollinators that support our wildlife and don't require mowing.
- Refuel your car and mow your lawn after 7pm, which helps prevent ground-level ozone.
- Next time you buy lawn equipment buy electric.

Reduce your business's impact

- Use video conferencing rather than traveling for meetings and promote telecommuting where possible. See City of San Francisco Telework Toolkit.
- Work to be designated as a Bike Friendly Business and encourage your peers to participate.
- Explore how you can offer your employees alternative commute incentives .
- Make - and implement - a Fleet Transition Plan to convert your vehicle fleet to electric vehicles.
- Participate in Bicycle Benefits to encourage customers to bike instead of driving to your business.

Buildings and Energy

Enhancing the resilience of Fitchburg's buildings while minimizing impacts by improving efficiency, utilizing renewable energy, and reducing on-site combustion.

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Sector Goals

by 2030:

33.4% drop in GHG emissions from 2022

7% reduction in electricity use

30% reduction in natural gas use

25% renewable energy

50% fewer people in energy poverty

What We Heard:

82%

of survey respondents support the City encouraging all rental properties to meet energy efficiency standards reducing costs for owners and tenants.

Equity Considerations:

The shift to sustainable energy requires investments in infrastructure and waste management, which, in turn, could worsen social disparities in Fitchburg. Insufficient funds for home upgrades or limited participation in renewable energy projects might marginalize certain groups. As society moves away from fossil fuels, traditional systems could become costlier and less reliable, increasing financial strain. Economically disadvantaged individuals are also more susceptible to climate change effects, as they have fewer resources to cope with weather extremes. Example potential impacts include:

Home Energy Efficiency Retrofitting: Individuals without financial resources often pay a substantially higher share of their income for heating and cooling, yet are unable to upgrade their homes to increase energy efficiency.

Renewable Energy Projects: Financial limitations prevent many from participating.

Electrification: The substantial initial expenses associated with transitioning from fossil fuel to electric heating systems present a barrier for lower-income households.

Energy consumption in buildings significantly contributes to greenhouse gas (GHG) emissions. This sector includes all residential and non-residential structures. GHG emissions come from direct sources, like on-site fossil fuel combustion for heating or cooking, and indirect sources, such as off-site fossil fuels burned to generate electricity. How we choose to design our buildings greatly influences future efficiency and comfort. Enhancing energy efficiency can lower GHG emissions and provide substantial cost savings for both homes and businesses. The City of Fitchburg can also achieve climate resilience and gain environmental, social, and economic benefits by improving its built environment.

Residential Energy

Fitchburg's residential sector consumes 92 million kWh annually, averaging 6,585kWh per household, with a 16.6% increase in total consumption since 2014. Due to population growth, however, per-household electricity use dropped by 7.6%. Additionally, the sector consumes over 6.5 million therms of natural gas annually, averaging 467 therms per household - representing a 7.5% increase in total use since 2014, but a per-household decrease of 14.8%.[1]

Non-Residential Energy

This sector consumes over 232 million kWh, equal to 19,121 kWh per job, with a citywide increase of 7.8% since 2014. Due to an increase in employment, however, the per-job electricity consumption increased at a slightly lower pace of 3.8%. Natural gas consumption for this sector is 9.5 million therms annually, representing a 2.4% increase in total use, and a per-job decrease of 1.3% since 2014.[1]

Strategies on the following pages show how we achieve our sustainability goals for Buildings and Energy.

Actions shown for each strategy outline steps the City and community can take to support the plan goals.

Strategy Metrics indicate how we can measure our progress on each strategy.

Strategy BE 1

Reduce total communitywide energy use 15% per-capita for natural gas and 7% per-capita for electricity by 2030.

Strategy Metrics:

Annual electricity use reported (utilities);
Annual natural gas use reported (utilities)

Homes constructed from 2000 to 2009 consume 15% less energy per square foot compared to those built in the 1980s, and 40% less energy than homes erected before 1950.[2] Retrofitting older homes with energy efficient appliances, insulation, and newer windows can provide significant opportunity to reduce energy consumption citywide. Within Fitchburg, 62% of owner occupied homes and 61% of renter occupied homes were built before 2000.[3] This share of housing stock alone represents a significant opportunity for reducing community-wide energy consumption—particularly within natural gas use.

ACTIONS

BE 1-1	Create an informational/outreach campaign to distribute energy efficiency, electrification, renewable energy, energy storage, and sustainable building practices content, incentives, programs available, and resources. Integrate information into an Energy Hub webpage. Include distribution through a New Fitchburg Resident packet, realtor partners, and other print pieces.
BE 1-2	Develop and promote a program for single- and multi-family rental housing policies that encourages meeting minimum energy efficiency levels and educating residents on energy-saving strategies they can implement. Use a rating system such as ENERGY STAR or HERS, or a "Green Landlords" certification program, to guide building owners and property managers on impactful improvements that can save tenants energy and money, and provide payback/ROI analysis to demonstrate financial viability as needed.
BE 1-3	Work with MGE, Alliant Energy, Project Home Weatherization Assistance Program, and local community organizations serving under-resourced households to promote participation in a residential and multi-family energy efficiency audit and upgrade program, including the Sustain Dane and Elevate Energy Efficiency Navigator program. Explore procuring funding to subsidize or fully cover costs of program for income qualified households. Goal: 300 households per year.
BE 1-4	Develop a city-hosted Energy Hub website with energy efficiency, electrification, renewable energy, energy storage, and sustainable building practices information and resources for residents and businesses. Resources to link to include Dane County Office of Climate and Energy, Wisconsin Focus on Energy, US Department of Energy, DOE Energy Savings Hub, ENERGY STAR, PACE Wisconsin, and other energy efficiency financing resources. Invite local HVAC heat pump, hybrid heat pump water heater, geothermal. solar and weatherization contractors to post content on City Energy Hub website.
BE 1-5	Work with partner organizations to promote participation in a Small Business Energy Efficiency program that encourages retro-commissioning, energy efficiency strategies, and operations and maintenance practices that improve affordability, comfort, and indoor air quality, in commercial and multifamily buildings. Provide information on financial incentives from 2022 Inflation Reduction Act as part of this promotion. Work with Fitchburg business groups to promote program among local businesses. Goal: 5 large, 20 small / medium size buildings annually.
BE 1-6	Establish a Building Performance Guide that encourages commercial and industrial buildings over 25,000 sf to track and report energy use – and eventually to implement specific energy efficiency actions. Include in data reporting of information on renewable energy purchases, renewable energy on-site generation, energy efficiency upgrades, waste management data (recycling, composting) and other relevant information. Leverage lessons learned from Madison's energy reporting initiative.
BE 1-7	Promote awareness of Focus on Energy and other available incentive programs for weatherization upgrades, energy efficient appliances, and deep energy retrofits for households and businesses, particularly those that prioritize support for income-qualified community members. Work with MGE, Alliant Energy, and other regional partnerships to identify existing and create additional financial incentives.

Strategy BE 2

Increase adoption of high performance building construction technology, achieving 1% Net Zero households and commercial properties community wide by 2030.*

* Net Zero buildings are energy efficient buildings that produce as much energy on-site as they consume in a year

High-performance buildings surpass standard energy-efficiency levels, usually by 30% compared to code-compliant structures, while Net Zero buildings both exceed energy-efficiency standards and produce as much energy on-site as they consume.[4,5] Drawing from recent new building permit data, the equivalent of 25% or more of Fitchburg's current homes and 5-10% of commercial establishments in the city could be constructed or renovated within a decade.[6,7] This underscores the potential to positively impact the city's building infrastructure by implementing climate action strategies that promote the adoption of cost-effective high-performance and Net Zero energy building practices.

Strategy Metrics:

New Building and Renovation Permits;
Certified Net Zero buildings

ACTIONS

BE 2- 1	Create a Net Zero Energy Building Guide or identify and link to existing resources providing building owners, renters, developers, designers, and contractors with detailed information on strategies to make new construction or significant renovation projects Net Zero Energy or Net Zero Energy ready. Include a project strategy checklist for building owners and teams to use and report sustainable strategies used.
BE 2- 2	City to provide the Net Zero Energy Building Guide or identify and link to existing resources providing information on the advantages of on-site renewable energy and all-electric buildings to property owners, developers, and stakeholders.
BE 2- 3	Encourage projects receiving city financing to meet energy efficiency, electrification, and solar ready or on-site solar goals in line with the goals of this plan and encourage projects in approved Planned Unit Districts to meet the same goals.
BE 2- 4	Establish a Net Zero Ready Stretch Code for new commercial buildings, multi-family residential buildings, and residential subdivision construction that improves energy efficiency and supports increased adoption of net zero construction techniques. Stretch code should include a "solar ready" requirement. Promote and encourage use of the stretch code by providing information and resources to property owners at all stages of engagement with the building permitting process including initial engagements. Goal: achieve 15 new single family units annually, 17 multi-family units, and 5 businesses built to stretch code requirements annually by 2028.

Strategy BE 3

Achieve 15% residential and commercial and industrial building "fuel switching" from on-site fossil fuel combustion to electrification by 2030.

Within Fitchburg, approximately 68% of residential heating is provided by natural gas, 30% by electricity, 0.5% fuel oil, 0.2% by wood, and 0.3% by solar.[8] As the city's electric grid approaches carbon neutrality, reducing emissions from building heating fuel becomes crucial.[9] Ultimately, eliminating all fossil fuel heating (oil, propane, natural gas) in the buildings sector will be necessary to achieve community-wide carbon reductions.[10]

Strategy Metrics:

Reported natural gas accounts (utilities);
New building and renovation permits

ACTIONS

BE 3-1	Connect landlords with contractors and information about electrification. The rental community presents a significant opportunity to realize benefits from switching to electric. Working with landlords directly to provide information and tools for transitioning to electric is an important foundational component of a broader electrification incentive or mandate program.
BE 3-2	Coordinate/identify and promote a residential and small business "Electrification and Energy Efficiency/ Weatherization" group purchase campaign annually to help reduce the costs of energy efficient heating systems such as air source heat pumps and ground source heat pumps through volume purchasing power (Goal: 150 households and 20 businesses annually). Program design should focus on improved equity in its implementation; and explore strategies to identify and support local heat pump, energy efficiency, and weatherization small business contractors to enable a competitive marketplace with more than one contractor to choose from. NOTE: Action may be implemented in combination with a renewable energy group purchase program action.
BE 3-3	Deploy and promote an incentive program, leveraging state and federal funding, for electrification for households and businesses. Work with MGE, Alliant Energy, and other regional partnerships to identify existing and create additional financial incentives to electrify new and existing buildings, particularly for low income households and small businesses. For example, rebates for panel upgrades, induction ranges, air and ground source heat pumps, heat pump water heaters, heat pump clothes dryers and other technologies which encourage the transition from fossil fuel combustion to electric energy use. Include incentives which prioritize support for income qualified community members. Goal: 10% residential market conversion (250 households annually) and 5% commercial/industrial market conversion (an estimated 25 commercial businesses, 10 industrial businesses annually) by 2030.
BE 3-4	Coordinate with regional efforts to conduct outreach and training with local contractors and businesses on electrification. Working with installers and other trade services promotes green job creation. These outreach efforts would provide tools and knowledge for businesses while also reinforcing the non-energy benefits of electrification such as improved resilience, air quality, and public health and safety

Strategy BE 4

Increase renewable electricity to 25% of community-wide residential, commercial, institutional, and industrial building electric use by 2030.*

* 10% on-site and 15% green source purchase (2022 baseline is 2%)

The GHG emissions associated with grid provided electricity use is anticipated to continue to reduce over the years.[9] Increasing consumer driven renewable energy purchases, however, is still beneficial to meeting our GHG reduction goals and provide cost savings and increased resilience potential.[11,12] As of 2022 there were 225 customer owned on-site solar arrays in Fitchburg, with an estimated generating capacity of 3 MW.[13] For residents and businesses that are unable to install on-site solar, purchase of renewable energy through MGE or Alliant Energy provides those property owners an opportunity to achieve Net Zero electricity use while supporting an important mechanism in cleaning the State's electric grid.[14, 15, 16]

Strategy Metrics:

Utility reported customer owned installations;
Utility reported customer purchased renewable energy

ACTIONS

BE 4- 1	Establish an expedited solar permitting process, including reducing or eliminating solar permit and plan review fees for residential projects, and achieve SolSmart Gold or Platinum community status. Collect and maintain data on solar array name plate capacities and estimated annual generation to support community-wide goal progress tracking.
BE 4- 2	Collaborate with other municipalities to actively lobby and advocate for improved State policies to expand solar including: WI community solar legislation similar to 2021 Senate Bill 490; enabling 3rd party power purchase agreements (PPA) and Solar Leases in WI; improved net metering policy requiring retail rate compensation for solar arrays up to 100KW, applicable to all electric utilities; establishing Community Choice Aggregation enabling legislation; establishing a renewable energy portfolio carve-out requirement; improved solar-ready requirements; improved support for electrification / fuel switching requirements; improved interconnection standards; establish shared renewable energy enabling legislation like virtual net metering.
BE 4- 3	Establish a Solar Ready Building Guide or identify and link to existing resources providing building owners, renters, developers, designers, and contractors with detailed information on strategies to make new construction or significant renovation projects fully Solar Ready, thus making on-site solar arrays more cost-efficient and easier to install.
BE 4- 4	Organize an annual Commercial property and Industrial property group purchase program. Goal: 5 participants with 150 KW installed annually.
BE 4- 5	Collaborate with partners and other municipalities, such as those active in the WI DNR Green Tier program, to advocate for accelerated grid 2.0 initiatives to ensure the electric grid can support a 100% renewable energy supply.
BE 4- 6	Collaborate with local Solar PV contractors, MGE, and Alliant Energy to identify infrastructure challenges to solar PV implementation throughout the community in support of the goals of the Sustainability Plan. Support MGE, Alliant Energy and collaborators in establishing a plan for overcoming infrastructure challenges identified, with a prioritization of resolving challenges at the city's most optimal sites.
BE 4- 7	Encourage new residential, new multifamily residential and new commercial buildings to be solar ready based on City's Solar Ready Guide, with flexibility for site suitability.
BE 4- 8	Promote participation in a residential Solar Group Purchase Campaign annually to help reduce the costs of solar installation through volume purchasing power (Goal: 50 households annually). Program design should focus on equitable implementation (residential and commercial). Program should also include strategies to support local small business solar installers, such as providing opportunities for small installers to collaborate, or having a competitive "marketplace" approach with more than one installer to choose from. NOTE: Action may be implemented in combination with the electrification and energy efficiency group purchase program action.

Strategy BE 5

Reduce share of population living in high energy poverty from 8% to 4% by 2030.

A household's energy burden—the percentage of income spent on energy bills—indicates energy affordability. An energy burden of 6% or higher is considered high.[17] Those facing energy poverty are more vulnerable to health issues, especially related to indoor temperature extremes.[18] As extreme weather events in Fitchburg become more frequent and severe, people in energy poverty will face increased climate vulnerability.[19,20] Energy efficiency and renewable energy can reduce energy bills for low-income households while also enhancing health, indoor air quality, safety, and climate resilience.

If not implemented carefully, energy sector climate actions can worsen energy inequity. Studies show energy efficiency projects in low-income areas can cost up to twice as much as in wealthier neighborhoods.[21] Additionally, mechanisms like incentives for renewable technology can increase inequity if not designed properly.[22] Over 21% of Fitchburg households are low income, so improving access to energy efficiency and renewable energy can reduce energy poverty and significantly contribute to the city's emissions reduction.[8, 23]

Strategy Metrics:

Reported household share with high energy burden (US DOE)

ACTIONS

BE 5-1	Collaborate with partners like Citizens Utility Board and others to regularly host Utility Bill clinics to help residents review their energy bills, discuss energy savings opportunities, complete rebate paperwork or purchase discounted efficiency products online.
BE 5-2	Organize education and outreach programs to promote low-cost ways to save energy and money, such as installing programmable thermostats, signing up for free energy-saving kits from Focus on Energy, and participating in state and federal energy efficiency and renewable energy incentive/rebate programs. Include information on energy efficiency and cost savings opportunities and incentives available for renters who are not able to make building energy system upgrade decisions. Link or integrate campaign with the City's Energy Hub website. Outreach should focus on effectively communicating with households of lower income and small businesses.
BE 5-3	Collaborate with MGE, Alliant, and other partners to explore the development of renewable energy programs which increase utilization of on-site / in-community renewable energy while creating benefit for low-income community members. Example programs include City of Dubuque Low Income Solar Renewable Energy Credit (SREC), Leech Lake Band of Ojibwe Community Solar for Community Action, and Texas Energy Poverty Research Institute Community Solar Program Model. Goal: 1,500 MWh clean energy delivered through programs annually by 2030.
BE 5-4	Collaborate with solar developers, Alliant Energy, and MGE to explore feasibility of using City of Fitchburg building rooftops or land for the development of community solar projects with prioritized participation by, or discounted rates for low-income community members. Promote the city's project as a case study and recruit other public agencies and multi-family property owners to explore implementation of similar projects.

Strategy BE 6

Improve total government building energy efficiency by 15% by 2030.*

* electricity and natural gas, including water and wastewater infrastructure.

Strategy Metrics:

City reported energy use

In 2022, the City of Fitchburg municipal buildings consumed over 4,115,000 kWh of electricity and nearly 87,782 therms of natural gas. Building energy consumption, including water service, represents over 65% of GHG emissions associated with municipal operations.[10] Increasing energy efficiency of municipal buildings by 15% would reduce 617,000 kWh of electricity and 13,000 therms of natural gas consumption annually, eliminating over 470 metric tons of GHG emissions annually.[10]

ACTIONS

BE 6- 1	Continue conversion of City-owned streetlights and signals to LED. Complete 100% conversion by 2028. Encourage electric utilities to convert all utility-owned streetlights to LED.
BE 6- 2	Require all new and existing municipal buildings to meet and maintain energy and resource efficiency standards meeting an ENERGY STAR rating of 75 or better, and built to meet or exceed IGCC code and report energy use on the City's website. Include in all facility design and construction RFP's a requirement for all new construction or major renovation projects to explore opportunities to advance towards Net Zero Energy. Invite County, School District, and other public agencies located within the City to participate in City's energy efficiency policy effort.
BE 6- 3	Continue to use results from City facility energy audits to prioritize City Facilities Capital Improvement Plans (CIPS) and maintenance improvements to achieve energy efficiency goals. Conduct City Building Energy Audit Updates on all primary City owned facilities by 2030 to review next-step improvement opportunities.
BE 6- 4	Conduct an occupancy and plug load energy efficiency study of primary city owned facilities and establish a "Plug Load and Occupancy Energy Efficiency Guide" outlining operational practices to advance the City's energy efficiency goals for City facilities. Provide training to all existing city employees and provide ongoing training to all new City hires.

Strategy BE 7

Achieve 15% government building thermal "fuel switching" from on-site fossil fuel combustion to electrification by 2030.

Strategy Metrics:

City natural gas accounts,
City reported fuel switching projects;
City reported natural gas consumption

Municipalities can provide leadership in illustrating the benefits of reduced on-site fuel combustion and beneficial electrification.

ACTIONS

BE 7- 1	Establish a policy by 2026 requiring all new municipally owned buildings to be 100% electric (or zero on-site fossil fuel combustion) and all municipally owned buildings to be 100% electric (or zero on-site fossil fuel combustion) by 2035.
BE 7- 2	Conduct an "Electrification Assessment and Action Plan" to outline actions and priorities for electrification of all City facilities to move towards zero on-site fossil fuel combustion. Work with regional energy partnerships to implement Plan for all City facilities, including pump and lift stations. Include new and existing buildings, explore strategies to address electricity storage, and create a case study to highlight and share challenges, solutions, and lessons learned to share with the broader community.

Strategy BE 8

Increase renewable energy to 100% of government building electric use by 2030.

*on-site and green source purchase (2022 baseline is 31%)

Municipalities can spearhead the adoption of renewable energy. On-site renewable installations offer the City a chance to explore developing micro-grids, energy storage solutions, and other strategies to enhance the energy resilience of City facilities.[24]

Strategy Metrics:

City reported on-site energy production;
City reported electricity consumption

ACTIONS

BE 8-1	Conduct a City Facility Solar Feasibility and Master Plan, as well as a Geothermal Feasibility and Master plan for all city facilities. Study should explore a range of ownership options including purchase and third party ownership (such as Power Purchase Agreements). Study should also identify strategies such as community solar subscriptions combined with Renewable Energy Credit purchases, to achieve renewable energy for considerations at sites determined to be inappropriate for on-site solar to achieve 100% renewable energy.
BE 8-2	Install solar on all City buildings and sites by 2030, where feasible, based on the findings and recommendations of the City Facility Solar Feasibility and Master Plan study. Explore implementation of micro-grid, solar+storage and other options for improved facility resilience. Explore including City Facility solar purchases in community-wide commercial solar group purchase campaigns.
BE 8-3	Establish a policy which requires all new construction and significant renovation projects for City facilities to be constructed to meet "Solar Ready" requirements and to include a solar feasibility assessment and project option for inclusion of on-site solar, include "Return on Investment" assessment, and incorporate solar where return is favorable.

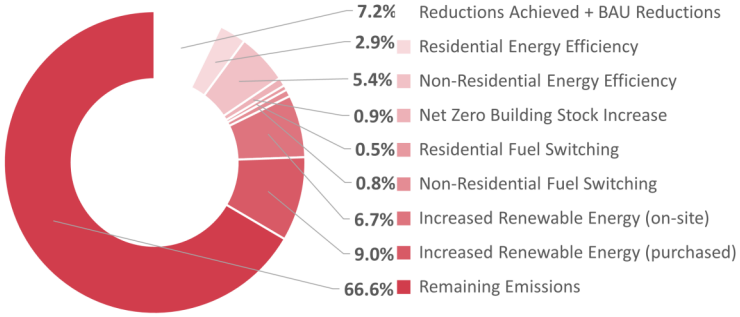
Planned Sector Emission Reductions Through 2030

The strategies and actions included in this section of the Sustainability Plan are projected to reduce the city's annual GHG emissions by 72,427 metric tons (MT) annually by 2030. In addition a reduction of 20,022 MT of "business-as-usual" emissions reductions are anticipated. The result is a total citywide Buildings and Energy sector reduction of 33.4% below 2022 levels.

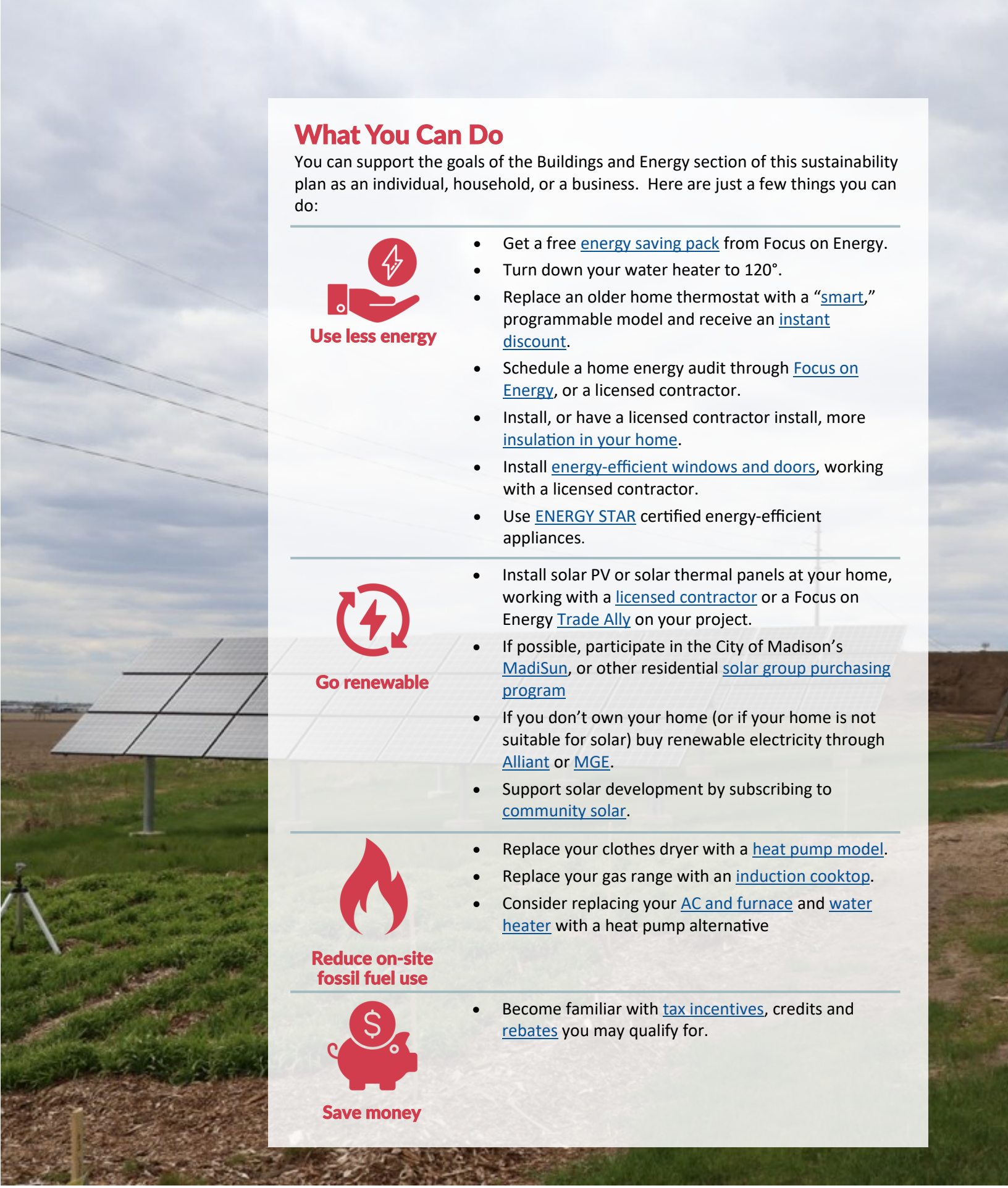
When compared to 2022 emissions, this is equivalent to eliminating over 14,470 of the city's current vehicles from the road, or **1.8 billion** cubic feet of human-made GHG atmosphere annually by 2030.

Sector Emissions Reduction below 2022 by 2030

The total change to sector emissions include plan reductions and business-as-usual (BAU) emission changes as follows:



Note: Reductions Achieved refer to emissions reductions that have occurred since 2014 based on the City of Fitchburg Community GHG Inventory. 'Business-as-Usual' (BAU) Reductions are anticipated reductions resulting from existing requirements or commitments, such as federal vehicle fuel efficiency standards and electric utility carbon-reduction commitments, which are outside the scope of this plan.



What You Can Do

You can support the goals of the Buildings and Energy section of this sustainability plan as an individual, household, or a business. Here are just a few things you can do:

Use less energy

- Get a free energy saving pack from Focus on Energy.
- Turn down your water heater to 120°.
- Replace an older home thermostat with a "smart," programmable model and receive an instant discount.
- Schedule a home energy audit through Focus on Energy, or a licensed contractor.
- Install, or have a licensed contractor install, more insulation in your home.
- Install energy-efficient windows and doors, working with a licensed contractor.
- Use ENERGY STAR certified energy-efficient appliances.

Go renewable

- Install solar PV or solar thermal panels at your home, working with a licensed contractor or a Focus on Energy Trade Ally on your project.
- If possible, participate in the City of Madison's MadiSun, or other residential solar group purchasing program
- If you don't own your home (or if your home is not suitable for solar) buy renewable electricity through Alliant or MGE.
- Support solar development by subscribing to community solar.

Reduce on-site fossil fuel use

- Replace your clothes dryer with a heat pump model.
- Replace your gas range with an induction cooktop.
- Consider replacing your AC and furnace and water heater with a heat pump alternative

Save money

- Become familiar with tax incentives, credits and rebates you may qualify for.

Waste Management

Decreasing environmental impacts and greenhouse gas emissions through enhanced recycling, material re-use, organic waste collection, and overall waste reduction.

Click here to return to TOC

Sector Goals

by 2030:

18.7% drop in GHG emissions from 2022

5% less solid waste generated

80% increase in organics diversion

40% increase in recycling diversion

What We Heard:

82%

of survey respondents support the City expanding food recycling / compost collection service in the community.

Equity Considerations:

Incorporating equity into solid waste management ensures all individuals benefit and can contribute to the solution. It is essential to overcome language, cost, and logistical barriers for broad participation. Reducing food waste can assist economically disadvantaged households. Equitable waste strategies support environmental sustainability and social justice.

Equity Program Examples:

San Francisco's Zero Waste Program[1] offers equitable recycling and composting services to every community sector, addressing language barriers through multilingual resources.

Food Programs[2] such as Foodbank For The Heartland reduce food waste by redistributing surplus from various sources to those in need, assisting low-income households.

The RecycleBank Program[3] incentivizes recycling by offering rewards, thus overcoming cost barriers and indirectly aiding economically disadvantaged households.

Waste management encompasses both municipal solid waste and recycling. The term considers total volume generated, demand, service capacity, and collection and disposal infrastructure. Municipal solid waste (MSW) impacts climate change, primarily through landfill methane and transport carbon emissions. Waste reduction, recycling, and organic collection mitigate these impacts. Less waste results in lower methane emissions from landfills. Recycling reduces resource extraction, conserves energy, and decreases carbon emissions. Composting organic waste lowers methane emissions, sequesters carbon, and provides eco-friendly fertilizer alternatives.

Solid Waste in Fitchburg[4,5,12]

Citywide municipal solid waste (MSW) handled has been estimated based on the city reporting. In 2022, citywide MSW totaled 6,336 tons. Of the MSW handled an estimated 1,604 tons (25.3% of total) were recycled, 759 tons (12%) were organics collection, and the remaining 3,937 tons (62.7%) were landfilled.

In 2021, the State of Wisconsin initiated a comprehensive, quantitative evaluation to understand the make up of the current waste stream (materials not diverted through recycling or organics collection) state-wide. The study assessed solid waste characteristics throughout the State. Based on the state's Waste Characterization Study for the South Central region, there may be waste diversion potential of up to 90% in the current landfilled materials (idealized maximum which includes 31.8% organics; 40.3% potentially recyclable paper, glass, and metal; 15.2% potential recoverable construction, textile, and electronics materials).

Strategies on the following pages show how we achieve our sustainability goals for Waste Management.

Actions shown for each strategy outline steps the City and community can take to support the plan goals.

Strategy Metrics indicate how we can measure our progress on each strategy.

Strategy WM 1

Decrease total annual municipal solid waste handled per capita by 5% by 2030.

Strategy Metrics:

Reported community-wide total MSW handled;
Total population (US Census)

The US EPA created a waste management hierarchy based on environmental impacts. This hierarchy prioritizes waste reduction, reuse, recycling, and organics recovery.[6] Reducing waste decreases the materials consumed and discarded, saving energy and lowering landfill greenhouse gas emissions. Homes and businesses that minimize waste can save hundreds of dollars annually.[7,8,9] Continuing to establish policies and programs to reduce the total volume of waste generated represents a significant environmental opportunity for Fitchburg.

ACTIONS

WM 1-1	Expand consumer education on sustainable consumption and materials management, including prevention of wasted food in households and businesses and low-carbon food consumption.
WM 1-2	Conduct a comprehensive waste composition study every five years to support accurate measurement of landfill diversion progress.
WM 1-3	Promote the Dane County Clean-Sweep program for disposal of paint and other hazardous household wastes, and partner with the County to host Clean-Sweep events in Fitchburg for local collection opportunities.
WM 1-4	Study current best practices and most effective progressive Pay-As-You-Throw (PAYT) solid waste rates and implement a restructuring of City solid waste collection rates to promote landfill diversion through the City's waste hauler Request for Proposal process.

Strategy WM 2

Increase organics and compostable diversion from 12% to 22% of total MSW handled by 2030.

Strategy Metrics:

Reported community-wide total organic collection;
Reported community-wide total solid waste landfilled

Most landfill gas arises from bacterial decomposition when organic waste breaks down by bacteria. Organic wastes include food, garden waste, street sweepings, textiles, wood, and paper products.[10] According to the State's Waste Characterization study, landfill waste in the South Central region may consist of over 50% organics, including paper, representing a significant emissions reduction opportunity for Fitchburg.[5]

ACTIONS

WM 2-1	Collaborate with partners including Dane County to conduct a Municipal Organics Program Study (yard waste, food waste and certified compostable products) to identify the most effective organics program solution for Fitchburg. Study should include exploration of organics drop-off sites, curbside collection, integrated "food scraps bag" program, workplace composting, and organics-to-compost partnerships with community gardens. Study should identify one or more pilot projects and recommended implementation actions.
WM 2-2	Implement pilot projects as recommended by the Municipal Organics Program Study.
WM 2-3	Promote back-yard composting by offering low-cost or free compost bins for residents.
WM 2-4	Based on Food Waste and Donation Opportunity outreach results, coordinate with partners including local food banks to support edible food donation and reduced food waste. Explore expansion of effort to create a robust food recovery program by identifying food retailer and restaurant partners for increased participation and support.
WM 2-5	Collaborate to promote the Wisconsin Sustainable Business Council's TRUE certification to meet zero-waste goals.

Strategy WM 3

Increase recycling diversion from 25% to 35% of total MSW handled by 2030.

The State of Wisconsin Waste Sort study indicates opportunities for increased capture of recycling, with as much as 43% of the total landfilled waste being potentially recyclable in the South Central region. The largest diversion opportunities may be in paper, plastics, and metal.[5]

Strategy Metrics:

Reported community-wide total recycling collection;
Reported community-wide total solid waste landfilled

ACTIONS

WM 3-1	Continue to implement a comprehensive communication campaign to provide standardized information, educational communications, and action items on waste reduction, organics collection, recycling, and hazardous waste handling to reach the commercial and residential sectors. Include updates on waste diversion programs available to residents and businesses.
WM 3-2	Offer positive reinforcement and indirect financial incentives to encourage businesses and residents to divert material from the landfill.

Strategy WM 4

Increase diversion of potential recoverables from 0% to 2% of total MSW handled by 2030.*

* from 18.9% to 16% of city landfill waste

The State of Wisconsin Waste Sort study indicates materials which may potentially be recovered for reuse like textiles, electronics, and construction materials may make up as much as 15% of total landfilled waste in the South Central region.[5] Diverting materials, especially wood and construction debris, offers a chance to reduce pollution, energy use, and water consumption within Fitchburg's supply chain.

Strategy Metrics:

Reported community-wide total recoverable materials diversion;
Reported community-wide total solid waste landfilled;
State of Wisconsin Waste Sort updates

ACTIONS

WM 4-1	Partner with local organizations (e.g., Habitat for Humanity Dane County ReStore) for demolition waste pickup and reuse.
WM 4-2	Support “collaborative consumption” community projects like tool libraries, repair cafes through mini-grant programs, or a Fix It Fair at the Library or other appropriate venue.
WM 4-3	Promote existing and explore potential for expansion of cooking oil recycling opportunities and list commercial vendors on City website.
WM 4-4	Promote and explore partnership with clothing businesses, reuse non-profits and textile recycling businesses to create a Clothing Reuse and Recycling pilot project to advance zero waste textiles within the City.

Strategy WM 5

Reduce solid waste and procurement impacts of government operations.

Local governments can be an example and support the adoption of improved recycling, materials reuse, and sustainable materials and waste management practices.[11] Reduced waste generation and diversion of materials can also save operational expense.[7]

Strategy Metrics:

Status of Sustainable Procurement Policy adoption;
Reported organics and recycling diversion rates from City facilities

ACTIONS

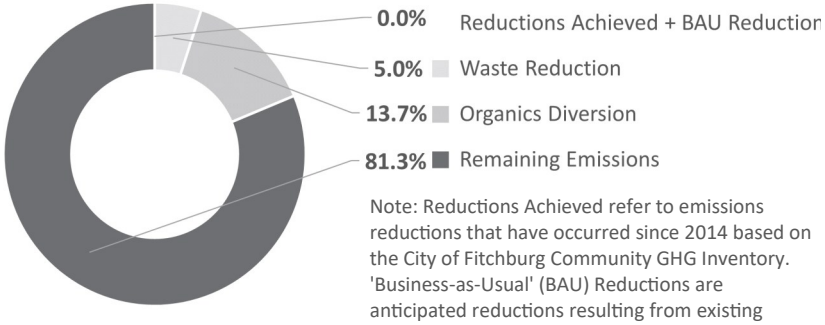
WM 5-1	Adopt a sustainable procurement policy or plan that designates third-party sustainability certification, sourcing, management and disposal requirements for City purchases (including both materials and food), with a preference for local businesses, lower upstream emissions, downstream diversion, and minimized refrigerant impacts. Educate staff responsible for purchasing on policy.
WM 5-2	Coordinate with public partners to establish paths towards Zero Waste program. Program to provide outreach to support recycling and zero waste strategies in schools, park facilities, public space, and City buildings. ("Zero Waste" as defined by the US Conference of Mayors: https://www.usmayors.org/the-conference/resolutions/?category=b83aReso050&meeting=83rd%20Annual%20Meeting)
WM 5-3	Continue to make City buildings and properties a model for organics composting by continuing existing organics diversion efforts and identifying and implementing opportunities to divert food waste.
WM 5-4	When issuing waste hauler request for proposals or considering waste hauler contracts, prioritize reduced resource consumption of the waste collection fleet through efforts such as use of alternative fuel, increased fuel efficiency, vehicle and pickup zoning/scheduling optimization, and other technologies.
WM 5-5	Provide outreach and education to Fitchburg businesses in reducing waste and increasing recycling/recycled content in their business operations and in their supply chains.
WM 5-6	Advocate with Dane County Department of Waste and Renewables to research and implement new technologies for enhanced landfill methane capture and beneficial use, such as opportunities for the development of green hydrogen, solid waste plasma gasification, or other technologies capable of expanding beneficial solid waste energy capture.

Planned Sector Emission Reductions Through 2030

The strategies and actions included in this section of the Sustainability Plan are projected to reduce the city's annual GHG emissions by 967 metric tons (MT) annually by 2030, a reduction of 18.7% below 2022 levels. This this is equivalent to eliminating over 150 of the city's current vehicles from the road, or **19 million** cubic feet of human-made GHG atmosphere annually by 2030.

Sector Emissions Reduction below 2022 by 2030

The total change to sector emissions include plan reductions and business-as-usual (BAU) emission changes as follows:



Note: Reductions Achieved refer to emissions reductions that have occurred since 2014 based on the City of Fitchburg Community GHG Inventory. 'Business-as-Usual' (BAU) Reductions are anticipated reductions resulting from existing requirements or commitments, such as federal vehicle fuel efficiency standards and electric utility carbon-reduction commitments, which are outside the scope of this plan.

What You Can Do

You can support the goals of the Waste Management section of this Sustainability Plan as an individual, household, or a business. Here are just a few things you can do:

Increase organics diversion

- Compost food and yard waste.
- Eat seasonally and shop local to ensure fresher, higher-quality produce with longer shelf life.
- Dispose of yard waste curbside or at a drop off site.
- Work with your employer/business to compost, or start organics recycling on site.
- Aim to eliminate food waste. Eat existing fridge contents first. Plan meals and shop accordingly. Learn more here.

Reduce what you throw away

- Use LEDs and rechargeable batteries to reduce eWaste.
- Upgrade, donate, or recycle old electronics.
- Use reusable bags for all shopping.
- Swap single-use plastics for durable, reusable alternatives.
- Choose items with no, minimal, compostable, or fully recyclable packaging.

Water and Wastewater

Reducing impacts of wastewater treatment and water consumption while increasing resilience to flooding and stormwater impacts in Fitchburg.

Click here to return to TOC

Sector Goals

by 2030:

6% drop in GHG emissions from 2022

6% less water use

6% less wastewater generation

Increase groundwater protection

What We Heard:

90%

of survey respondents are moderately, very, or extremely concerned about potential impacts of climate change on the availability of clean drinking water.

Equity Considerations:

Climate change affects water availability and quality, hitting underserved communities hardest due to limited adaptation resources.[1] These communities often live in flood-prone zones, facing risks from untreated sewage exposure. Equitable climate adaptation involves inclusive approaches benefiting all. This encompasses extending resilient infrastructure investment to all areas, aiding lower-income households in accessing water-saving technologies, and promoting public involvement in decision-making processes.

Equity Program Examples:

Involving Disadvantaged Communities[2] - a California initiative providing funding for water infrastructure in at-risk regions.

Leak Free Sacramento[3] - assists low-income households with leak repair and obtaining water-efficient appliances to encourage water conservation.

Flint, Michigan's Citizen Water Advisory Committee[4] - a local government committee structure that guarantees resident involvement in decisions impacting their water safety.

Climate change adaptation, water, and wastewater management intersect closely. Temperature and rainfall shifts due to global warming are anticipated to affect water availability and quality, necessitating adaptive measures in Fitchburg.[5] Strategies such as water conservation, effective irrigation, and xeriscaping can mitigate water risks and climate-related stresses by optimizing scarce resources.[6,7]

Heavy rainfall may stress wastewater infrastructure, leading to sewage discharge into water bodies.[8] Adaptive measures involve enhancing capacity at wastewater facilities, deploying green infrastructure like rain gardens and bioswales for stormwater control, and preventing contamination. Integrating climate change forecasts into planning aids proactive adaptation, bolstering the sustainability of water and wastewater management. Emphasizing resilience through strategies that anticipate climate impacts ensures safe water and efficient wastewater treatment, safeguarding public health, the economy, and the environment in Fitchburg.[9]

Regional Water Stress

By the year 2025, it is projected that 2 billion individuals will reside in regions afflicted by a lack of water, while half of the global population will inhabit areas facing water stress.[22] The Fitchburg region has experienced a decline in water yield of about 10% since 1985. Looking ahead to 2050, the region should prepare for a surge in water demand that could exceed 20%.[10]

Strategies on the following pages show how we achieve our sustainability goals for Water and Wastewater.

Actions shown for each strategy outline steps the City and community can take to support the plan goals.

Strategy Metrics indicate how we can measure our progress on each strategy.

Strategy W 1

Promote increased water conservation citywide with a reduced water use and reduced wastewater generation of 6% by 2030.

Strategy Metrics:

Reported community-wide water consumption

Based on City of Fitchburg data, water consumption citywide increased 13.4% from 2014 to 2022, on a per-capita basis this is a reduction of 4.2% which illustrates the potential for water efficiencies.[11] Wastewater generation over the same period, however, decreased 2.7%.[12] Conserving water is essential in tackling climate issues. The global worry over water shortage is worsened by climate shifts, which will affect Fitchburg as well. Cutting down water consumption relieves strain on freshwater supplies, aiding ecosystems and biodiversity.[6] Research suggests that about 12% of city water distribution is lost through leaks in pipes annually.[13] For Fitchburg, this may mean losing up to 165 million gallons of water every year.[14]

ACTIONS

W 1-1	Explore rate design structures that incentivize reductions in water consumption and implement change to rate structure based on findings. Include utility services and capacity support to implement income-based payment plan. Include education and engagement plan to raise awareness about climate change and water efficiency.
W 1-2	Facilitate reduction of water use by top 20 customers through an opt-in program. Offer free technical resources to large institutions and businesses to identify specific opportunities for employees or customers to conserve water and incorporate water efficiency into internal operations.
W 1-3	Reduce landscaping water use by encouraging water-efficient irrigation systems, grass replacement, and planting native and drought-resistant trees and vegetation.
W 1-4	Explore funding opportunities to help low and middle income households reduce water use and their water costs.
W 1-5	Implement or expand water leak detection within municipal water supply system.
W 1-6	Evaluate the potential for installation of rainwater collection systems at City facilities for graywater uses such irrigation and investigate opportunities for graywater reuse at existing and new City facilities and properties.
W 1-7	Implement a policy to require installation of rainwater collection systems and WaterSense water efficient fixtures and appliances at all City facility projects and encourage all projects receiving City Tax Increment Financing, or public funding to do the same. Provide information and technical assistance to projects as needed.

Strategy W 2

Identify probable flooding and stormwater issues and implement plans to meet projected storm water and flood mitigation requirements related to climate change or other impacts.

By 2100, Fitchburg could see a potential surge of 10% to 20% rise in annual rainfall and a significant increase in heavy rain events.[15,16] These shifts are likely to result in more stormwater runoff and flash floods.[17] Traditional infrastructure planning relies on historical rain data. To adapt to climate shifts, we must ensure that infrastructure and planning standards integrate forecasts, such as those provided by NOAA and others, which account for heightened precipitation and more intense rainfall events.

Strategy Metrics:

Citywide percentage of impervious ground cover, use of permeable pavement;
Citywide installations of green infrastructure

ACTIONS

W 2-1	Promote the increased use of permeable pavement and other green infrastructure (e.g., swales, rain gardens, urban tree canopies) through the City's Stormwater Management Credit program. Explore revision or expansion of the program to increase incentivization for low and middle income residents and/or those areas at higher risk of flooding / flash flooding.
W 2-2	Promote native landscaping, restore and conserve habitat; encourage rain gardens on private property, avoid turf grass, and convert City-owned space to include stormwater absorption features. Tree selection should consider both those species native to the area and its current climate patterns, found in the city's Urban Tree Guide; and those on the "Adaptive Planting List," which will remain resilient and even thrive through projected local climate shifts (refer to City of Fitchburg Ground Cover Study and other related assessments).
W 2-3	Target specific types of infrastructure to implement green infrastructure including: parking lots, alleys, parks, vacant lots, parkways, and grading near sidewalks. In addition, identify properties owned by other public entities that have a high potential for improved ecological management to improve stormwater management functions (school districts, metro transit, WI DNR, Dane County).

Strategy W 3

Increase groundwater, stream, river and wetland water quality protection and restoration.

Chloride from road and sidewalk salt dissolves easily, increasing water toxicity for aquatic life.[18] Overusing water softeners raises wastewater salinity, harming water quality. Actions to reduce the use and potential runoff of chlorides into surface water bodies can have significant sustainability benefits.

Strategy Metrics:

Reported road salt use;
USGS monitoring at Swan Creek;
City's water quality model for TMDL reachsheds

ACTIONS

W 3-1	Promote the use of the Madison Metropolitan Sewerage District's softener self-screen tool to increase home water softener efficiencies.
W 3-2	Reduce chlorides draining into environment (road and sidewalk salt, water softeners) through behavior modification, promoting other resources for water softener upgrade/replacements, evaluating potentials for municipal reductions in salt use.
W 3-3	Educate residents on alternative products to road and sidewalk salt for ice reduction which are less damaging to the environment.
W 3-4	Provide information to encourage and promote home water softener alternatives and reduction.
W 3-5	Establish a reduction-based water softener rebate program to incentivize water softener optimization, removal, or replacement with low/no chloride impact.
W 3-6	Discourage use of soft water for outdoor spigots during new construction.

Strategy W 4 — Educate, engage, and empower the public on water quality and conservation.

Education is crucial to promote sustainability and climate action. It helps people understand impacts and empowers them with the knowledge, skills, values and attitudes needed to act as agents of change. Research also shows that sustainability and climate education can help advance sustainability measures and reduce emissions, while also reducing people's vulnerabilities to acute and chronic environmental hazards.[19,20,21]

Strategy Metrics:

Status of communication and engagement efforts

ACTIONS

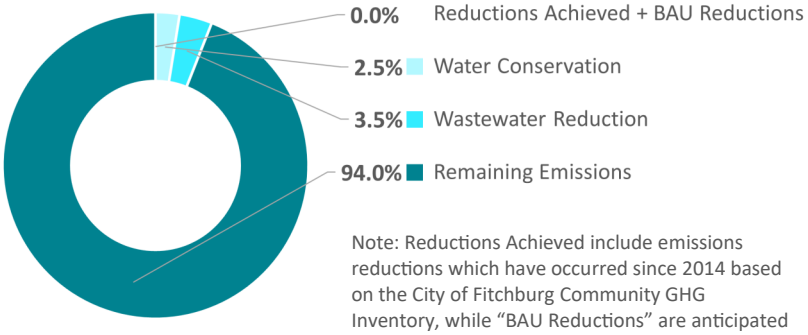
W 4- 1	Modify stormwater utility bills to provide education to residents on what actions they can take to reduce their risk to extreme precipitation events and flash flooding. Develop an information hub with tools and resources.
W 4- 2	Expand public education about the value of watersheds, rain gardens, and low-impact development to address stormwater run-off.

Planned Sector Emission Reductions Through 2030

The strategies and actions included in this section of the Sustainability Plan are projected to reduce the city's annual GHG emissions by 166 metric tons (MT) annually by 2030, a reduction of 6% below 2022 levels. This this is equivalent to eliminating over 26 of the city's current vehicles from the road, or **3.2 million** cubic feet of human-made GHG atmosphere annually by 2030.

Sector Emissions Reduction below 2022 by 2030

The total change to sector emissions include plan reductions and business-as-usual (BAU) emission changes as follows:



Note: Reductions Achieved include emissions reductions which have occurred since 2014 based on the City of Fitchburg Community GHG Inventory, while "BAU Reductions" are anticipated emissions reductions from existing commitments or trends, known as "business-as-usual" projections.

What You Can Do

You can support the goals of the Water and Wastewater section of this Sustainability Plan as an individual, household, or a business. Here are just a few things you can do:

Reduce your use inside

- Be mindful of your water use and focus on changes in habits such as turning off water when brushing your teeth and taking shorter showers.
- Trade your shower heads and faucets for WaterSense labeled low-flow, water-efficient options.
- Install - or have a licensed plumber install - a WaterSense labeled, water-saving low-flow toilet.
- Install a leak detection system.
- Replace your clothes washer and dishwasher with a low water use unit, and avoid running small or partial loads.

Reduce your use outside

- Replace your lawn with prairie grass, wildflowers, or landscape using xeriscaping principles.
- Collect rainwater in rain barrels to water your lawn and/or plants.
- If you have a lawn and garden irrigation system, or use hoses and sprinklers, water thoroughly less often, and do so in the early morning or evening.
- Retrofit existing irrigation systems with smart irrigation controls that use soil moisture and weather data to determine irrigation needs.
- Practice recommended pruning, fertilization, and mulching techniques to reduce landscape water usage and contamination.

Protect water quality

- Reduce your salt use on your driveway and walkways - learn more here and here.
- Follow leaf-free streets practices.
- Participate in the City's "adopt a storm drain" program.
- Volunteer for the annual Earth Month Waterway Cleanup events.

Local Food and Agriculture

Enhancing the resilience of our food systems, improving access to food and ensuring food security, and preserving agricultural land while minimizing their environmental impacts.

Click here to return to TOC

Sector Goals

by 2030:

Increase use of sustainable agriculture practices

30% reduction in food insecurity

Preserve existing agricultural land

What We Heard:

86.4%

of survey respondents are moderately, very, or extremely concerned about potential climate change impacts on food insecurity.

Equity Considerations:

"Food deserts" exist in low-income areas with limited access to supermarkets, depriving residents of affordable, nutritious food.[7] Coupled with many fast-food restaurants, this creates "nutrition deserts."[8] Efforts to address this through local food programs often unintentionally sustain inequities. These initiatives, designed by the dominant population, may overlook marginalized individuals who cannot afford local or organic food, perpetuating food insecurity.[9]

Equity Program Examples:

Philadelphia Food Trust[10] - an initiative to address food deserts involves partnering with local supermarkets and community organizations to increase fresh food availability in underserved areas.

Healthy Bodegas Initiative[11, 12] – a City of New York program to convert local corner stores into providers of healthier food.

Daily Table[13] a nonprofit community grocery store chain, aims to offer fresh, convenient, and nutritious food at affordable prices for everyone.

Transporting food over long distances consumes fossil fuels and releases greenhouse gases. The prolonged duration of such transport heightens the demand for energy and carbon-intensive refrigeration. Reducing the need for transportation and refrigeration makes our food supply more sustainable.[1]

Purchasing food locally can lower the carbon footprint of our diet and boost the local economy. Research shows that produce farms in local food markets create about 32 jobs for every $1 million in revenue, compared to only 10.5 jobs for those in wholesale channels.[2] Additionally, community gardens and neighborhood gardening foster social and community benefits, such as enhancing sense of community, offering multi-generational activities, providing outdoor low-impact exercise, and supporting habitats for plants, animals, and pollinators.[3]

Our food system is also at risk from climate change impacts.[4] These risks include physical effects like extreme precipitation and heat, crop and livestock issues such as animal heat stress, and biological problems like rising invasive insect infestations and interruptions to natural cycles. Additionally, there are socioeconomic impacts. Currently, food insecurity—disruptions in nutrition availability due to lack of money, access, or other resources—is inequitably distributed: those with low incomes are nearly three times more likely to face food insecurity.[5] We should expect that the climate change vulnerabilities of our national food system will worsen the inequities of food security across all communities.[6]

Strategies on the following pages show how we achieve our sustainability goals for Local Food and Agriculture.

Actions shown for each strategy outline steps the City and community can take to support the plan goals.

Strategy Metrics indicate how we can measure our progress on each strategy.

Strategy FA 1

In order to reduce climate shocks to agricultural lands, increase the portion of farms that use regenerative agricultural practices by 25% by 2030.

Farm crop practices can affect the greenhouse gas emissions associated with soil management. Soil emissions result from fertilizers, specific crops, and soil changes through irrigation.[14]

Regenerative farming practices can help to both reduce GHG emissions and reverse soil degradation.[15,16] These practices include rotational grazing, mixed crop rotation, cover cropping and no-till farming, which reintroduces carbon back into the soil as crop residues are pressed down when seeding.

Strategy Metrics:

Reported share of farms using regenerative practices (USDA)

ACTIONS

FA 1-1	Partner with Dane County to promote conservation programs and funding to farmers in Fitchburg, with a focus on programs and funding that sequester carbon, such as the Continuous Cover Program.
FA 1-2	City of Fitchburg should communicate regularly with Dane County staff working with farmers to transition farms to regenerative practices to express support of these programs.
FA 1-3	Encourage farmers using regenerative practices to list their farms and products on REAP Food Groups Farm Fresh Atlas to broaden awareness of what they are growing and what local food is available. This can also be accessed by restaurants and food service agency's seeking information about what local foods are available.
FA 1-4	Partner with Dane County Land and Water Resources and other partners to support mapping of existing and potential crop varieties against future climate projections such as extreme heat, drought, and flood risk to support the selection of those that are better-adapted to future conditions. Collaborate with partners to promote awareness of resilient crop options among farmers.

Strategy FA 2 — Reduce the level of food insecurity 30% by 2030.

Strategy Metrics:

Food insecurity reported in City and County;
Reported share of food waste characteristics data

Nationally, an estimated 30-40% of the food supply is wasted.[17] Fitchburg's solid waste stream contains approximately 900 tons of food waste each year based on the State of Wisconsin's Waste Characterization Study for the South Central region.[18,19] This waste not only generates greenhouse gas emissions but also represents an annual economic loss of $1,000,000.[20] Worse, wasted food could have benefited families in need. The resources used in producing that food, such as land, water, labor, and energy, could have been more productively utilized. Reducing food waste will support Fitchburg's sustainability goals and may also decrease food insecurity within the community.

ACTIONS

FA 2-1	Partner with Dane County and others to encourage and support the acceptance of Electronic Benefits Transfer (formerly food stamps) at all markets and groceries, and educate EBT/SNAP users about using their benefits to purchase local food. Explore the development of a "Double SNAP Dollar" program at all Farmers Markets to increase access to locally grown fresh produce for low income households.
FA 2-2	Work with community and regional partners to support and facilitate food donation programs. Food donation programs reduce the amount of healthy, safe food that goes to waste and redirects it to those in need.
FA 2-3	Allow city facilities to be used as Community Supported Agriculture drop off sites.
FA 2-4	Collaborate with partners to promote awareness and participation among community members of opportunities for subsidized or affordable locally grown produce such as FairShare CSA Coalition.
FA 2-5	Work with community organizations, neighborhood groups, and public libraries to organize a garden-tool lending program and garden bounty exchange program.
FA 2-6	Encourage CSAs, markets, urban gardens, etc. and provide support incentives for these projects.

Strategy FA 3

Design and implement methods to protect and preserve 50% of the existing food-producing agricultural land in the city.

The US agriculture system, on a national scale, faces vulnerability to regional climate impacts.[21] These increasing pressures come at a time when over 100 acres of farmland are lost to development every hour in the United States.[22, 23] Preserving and safeguarding the region's agricultural land is crucial for bolstering the resilience of local food systems. Preserving agricultural lands can also help support biodiversity.[23]

Strategy Metrics:

Total acres of agricultural land in City and County

ACTIONS

FA 3-1	Identify existing programs and organizations that support farmland preservation and connect farmers with those opportunities to help maintain existing farmland within Fitchburg and protect it from development for future use. Available preservation tools include Fitchburg's Farmland Preservation Plan; incentives or use of voluntary permanent easements; renewable energy development such as "solar farm" leases; and Wisconsin's Farmland Preservation Program. Potential partner organizations include American Farmland Trust, National Black Farmers Association, National Black Food and Justice Alliance, Farm Foundation, and Center for Agriculture and Food Systems.
FA 3-2	Promote and expand public education campaigns to encourage purchasing and procuring locally grown and produced food at the individual and institutional level.

What You Can Do

You can support the goals of the Local Food and Agriculture section of this Sustainability Plan as an individual, household, or a business. Here are just a few things you can do:

Grow your own

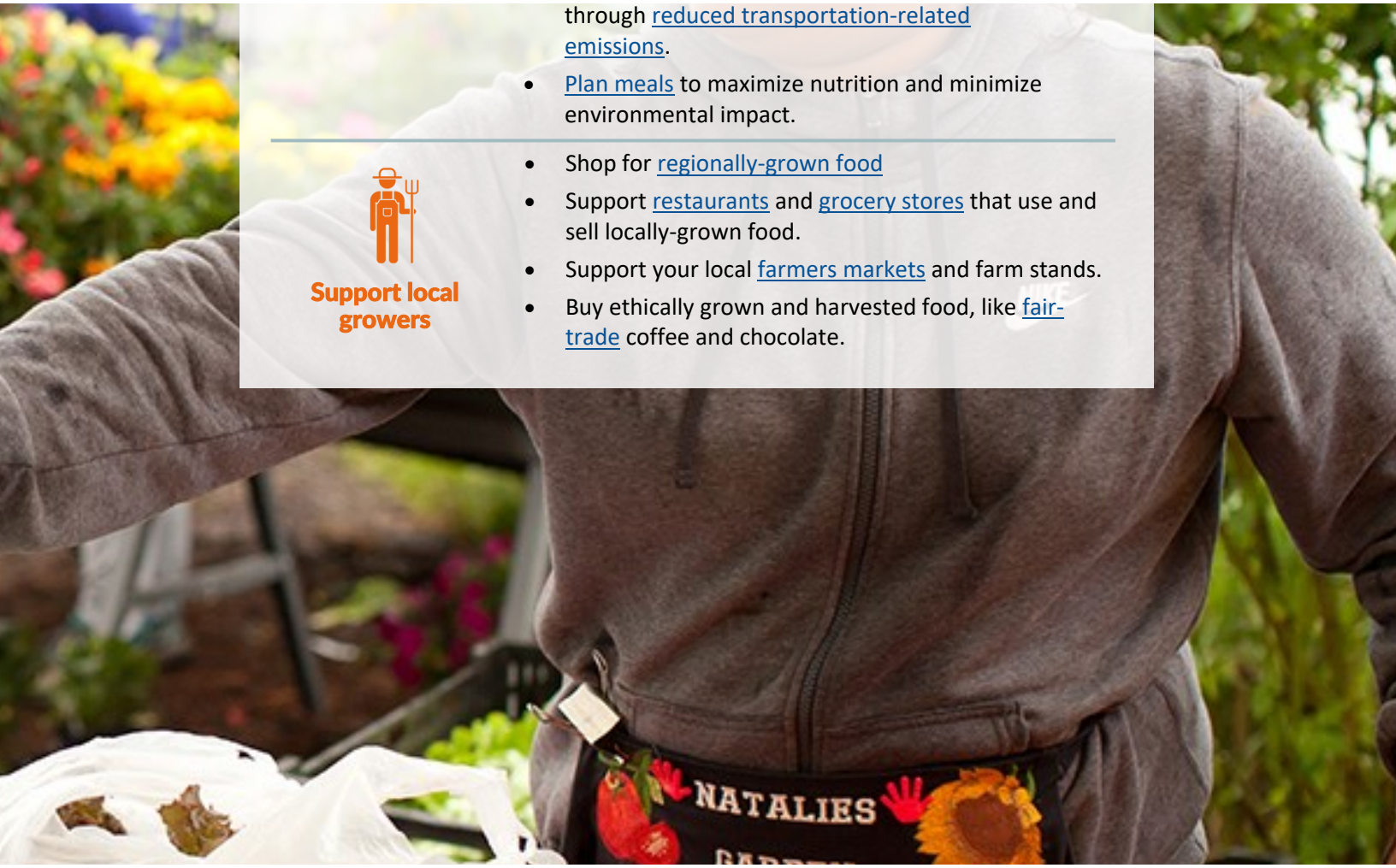
- Start a vegetable garden in your yard.
- See if there is a community garden near you, or work with others to start a community garden so you can grow your own.
- Explore back-yard poultry keeping.
- Plant fruit or nut bearing trees or shrubs that are well suited for our hardiness zone on your property.

Eat sustainably

- Eat a plant-rich diet. Animal products are extremely GHG-intensive to produce compared to plants. Eating less meat and dairy will reduce emissions associated with food consumption. A great place to start is with "Meatless Mondays".
- Eating foods that are in season and suitable for the Wisconsin climate will make a difference through reduced transportation-related emissions.
- Plan meals to maximize nutrition and minimize environmental impact.

Support local growers

- Shop for regionally-grown food
- Support restaurants and grocery stores that use and sell locally-grown food.
- Support your local farmers markets and farm stands.
- Buy ethically grown and harvested food, like fair-trade coffee and chocolate.



Greenspace and Ecosystems

Supporting community adaptation through expanded green infrastructure and enhanced ecosystem resilience.

Click here to return to TOC

Sector Goals

by 2030:

37% more tree canopy coverage (by 2050)

5% more prairie grass and less turf

5.5% less dark impervious surfaces

Increase biodiversity and climate resilience of green spaces

What We Heard:

90%

of survey respondents are moderately, very, or extremely concerned about potential tree or native plant loss due to climate change impacts.

Equity Considerations:

Neighborhoods with marginalized and vulnerable populations often lack tree canopy coverage, missing out on benefits like environmental enhancement, economic gains, and improved quality-of-life. These areas also endure the urban heat island effect and pollution disproportionately, with higher temperatures from fewer trees and more heat-absorbing surfaces. As a result, residents face heightened heat, discomfort, and health risks, worsening environmental inequalities.

Equity Program Examples:

Pittsburgh's Strategy for Equitable Street Tree Investment prioritizes tree funding in underserved and vulnerable areas.[1]

Depave Portland is a program that increases resilience and equity by converting "over-paved areas" into parks and other community-beneficial spaces.[2]

Incentives, such as New York City's Green Roof Tax Abatement initiative, offer tax credits covering half of installation expenses.[3]

Trees and natural ground cover are essential for community health, enhancing air and water quality, reducing energy use in buildings, and aiding climate mitigation.[4] Our knowledge of tree benefits now includes mental and physical health improvements. Studies indicate that nature interactions, such as visiting parks, significantly improve health and lower stress levels.[5] Trees play a crucial role in filtering air, eliminating harmful pollutants like carbon monoxide, particulate matter, and ground-level ozone, which can be toxic at high concentrations and lead to asthma and other respiratory issues.[6]

Prairie Grass and Climate Action

Replacing lawns with native grasses and wildflowers is a strong climate resilience approach. Native grasses need less water and maintenance, which reduces irrigation, the need for toxic fertilizers and pesticides, and lawn care emissions.[7] Their roots improve soil retention, aid water absorption, prevent floods, and store carbon. Additionally, native grasses support biodiversity and create habitats for wildlife.[8]

Impervious Surfaces and Heat

Increased impervious surfaces, such as pavement and buildings, amplify a community's heat island effect. This effect results in urban areas being warmer than rural ones because of the sun's heat being trapped by human-made structures. Heat islands can greatly intensify extreme heat events, causing more discomfort and health risks. Studies indicate that impervious surfaces correlate with higher temperatures. Neighborhoods with more pavement and fewer trees endure more intense heat.[9]

Strategies on the following pages show how we achieve our sustainability goals for Greenspace and Ecosystems.

Actions shown for each strategy outline steps the City and community can take to support the plan goals.

Strategy Metrics indicate how we can measure our progress on each strategy.

Strategy GE 1

Increase tree cover, particularly in the priority neighborhoods, from 21.9% to 30% by 2050 with growth coming from non-invasive species and an emphasis on climate adaptive species.

Fitchburg's tree canopy minimizes stormwater runoff, ensures clean drinking water, mitigates urban heat islands and micro heat islands, lowers building energy consumption, captures atmospheric carbon dioxide as a long-term carbon sink, and promotes economic growth.[10,11,12] Enhancing tree canopy coverage and health will offer vital climate adaptation services.[13,14]

Increases in tree coverage should be prioritized to balance the potential for increased tree canopy with the opportunity to improve tree canopy benefit equity, potential to positively impact as many households as possible, and the need for mitigation of heat island impacts. See the City of Fitchburg's Ground Cover, Heat Island, and Carbon Sequestration Study for suggested tree canopy increases by neighborhood and the criteria it is based upon.

Strategy Metrics:

Reported community-wide tree canopy coverage by census tract / block; Reported vulnerable population demographics by census tract / block (City Ground Cover Study updates)

ACTIONS

GE 1-1	Update the City's Ground Cover, Heat Island, and Carbon Sequestration Study every 5-7 years, ensuring alignment with City's tree canopy goals and Urban Forestry Strategic Plan. Maintain a current street tree inventory to refine targets and goals for tree canopy cover and identify strategies to achieve them.
GE 1-2	Support the increase of the city's urban tree canopy by identifying programs and suitable locations to preserve, maintain and expand Fitchburg's urban tree canopy. Establish an implementation plan to meet the City's ground cover and tree canopy goals by neighborhood/census tract based on the City's Ground Cover, Heat Island and Carbon Sequestration Study and develop species diversity goals for the City. Promote the City's Urban Tree Guide for recommended tree species.
GE 1-3	Collaborate with partners to create or promote existing communication campaigns and educational resources providing information on beneficial and climate adaptive tree species, how to care for trees, "carbon gardening" strategies for ornamental gardens and produce gardens, tree profile rebuilding, elimination of synthetic fertilizer and pesticide use, high mow deck settings, use of biochar amendments, polyculture lawn mixture and other beneficial greenspace practices included in this plan. Include information on City website.
GE 1-4	Continue prioritizing tree planting and enhance the maintenance of both healthy trees and mature canopies on public properties and streets. Additionally, develop programs for restoring tree crowns and rebuilding soil profiles for trees impacted by construction or soil compaction. Prioritize new tree plantings in areas of the City with increased heat island impacts as identified in the City's Ground Cover, Heat Island and Carbon Sequestration Study.
GE 1-5	Encourage soil profile rebuilding (by contractors) at all building project sites or compacted soil conditions to reduce erosion and runoff contaminated with fertilizers, increase soil carbon stores, support long-term soil building, and improve new tree survival and growth rates.

Strategy GE 2

Increase pollinator supportiveness of lawns and grasslands in City and achieve a 5% turf replacement with native, pollinator supportive plantings community-wide by 2030.*

* from 3,288 acres to 3,123 acres

Substituting lawns with native grasses and wildflowers establishes an authentic, natural American landscape. Converting turf areas to native grasses increases ecosystem sustainability, aids in climate change adaptation, and offers refuge and sustenance for songbirds and other small animals. Unlike conventional lawns, native grasses enhance water quality, diminish air pollution, rehabilitate and safeguard habitats, and improve carbon sequestration.[16,17,18]

In Fitchburg, 54% of grasslands are manicured lawns, presenting a significant chance for turf reduction. This reduction can enhance stormwater absorption, diminish potable water consumption, and boost soil carbon levels.[19,20,21] Neighborhoods with higher grass coverage percentages may present the best opportunities for replacing turf with native grasses and wildflowers.[15]

Strategy Metrics:

Reported community-wide lawn and native grass coverage (City Ground Cover Study updates)

ACTIONS

GE 2-1	Conduct a park and city facility turf analysis to identify turf locations on public property that could be converted to pollinator supportive native grasses or forests instead of lawns with appropriate ecosystems (plant/animal communities) for the existing soil type and topography. Avoid planting "pollinator gardens" in areas of high vehicular traffic areas such as roadway medians, roundabouts, and tree terraces. Establish an implementation plan and execute conversions.
GE 2-2	Require integrated pest management practices and non-petrochemical fertilizer use on City-owned land.
GE 2-3	Establish ‘demonstration yards’ on City-owned property to exhibit strategies for increasing pollinator-friendly landscaping, native plantings, and permaculture.
GE 2-4	Reduce hardscaping and impermeable surfaces on parklands, encourage reduction of unused parking lots, construction of water permeable parking lots and walkways.
GE 2-5	Require the use of native plants in landscaping at City-owned properties.
GE 2-6	Explore partnerships and opportunities to communicate the sustainability benefits of natural landscaping through publications, newsletters, and the City's website.
GE 2-7	Restore City-owned properties as well as turf borders of trails and paths between greenspaces to native plants and ecosystem types where feasible under the advice of native plant experts.
GE 2-8	Encourage sustainable landscaping in City publications, on the website and in social media.
GE 2-9	Establish a communication/education effort to clarify the City of Fitchburg code allowance of lawn alternatives including native grasses, wild flowers, vegetable gardens, etc.

Strategy GE 3

Reduce heat island effect through Community-wide "dark" impervious surface coverage reduction, particularly in neighborhoods identified with higher heat island impacts, from 9.2% to 8.7% by 2030.*

* from 1,900 acres to 1,800 acres

The heat island effect describes the situation in developed areas where atmospheric and surface temperatures are higher than in nearby rural regions due to human activities and infrastructure. This effect heightens discomfort and health hazards, particularly during heat waves, expected to worsen in Fitchburg.[22,23] There's a direct link between a city's impervious surface coverage, especially dark-colored areas, and the rise in heat island temperatures.[9] Reducing impervious surfaces, particularly those with darker materials, will mitigate heat island effects in the city.

Strategy Metrics:

Reported community-wide impervious surface and "dark" impervious surface coverage (City Ground Cover Study updates)

ACTIONS

GE 3-1	Encourage through both direct and indirect communication strategies all commercial development projects in Fitchburg to implement commercial scale heat island mitigation strategies including cool surfaces, solar-friendly landscape shading strategies (tree species, size, and placement designed to maintain rooftop solar PV potential), impervious surface reduction, and breeze capture.
GE 3-2	Develop educational and informational resources explaining the drivers and impacts of heat island and solutions which may offer multiple benefits for property owners and users to share with residents and businesses.
GE 3-3	Establish City of Fitchburg Paving Standards for paving systems that reduce localized heat islands, promote groundwater retention, or minimize rainwater runoff and shall update those standards every five years. Use Paving Standards to guide municipal pavement projects (paths, parking lots, alleys, streets, etc.) and encourage their use by residential and non-residential property owners.
GE 3-4	Explore incentives for property owners and developers to plant shade and water-absorbing trees and replace turf landscaping with native prairie, wild flower, and savanna plantings. All plantings should be encouraged only where site-appropriate. Prioritize areas with the highest heat island coefficients as identified in the City's Ground Cover, Tree Canopy, and Carbon Sequestration Study.
GE 3-5	Determine if existing properties in the City of Fitchburg have installed "Green Roof", "Green Wall", "Cool Roof", "Cool Building" and "Cool Pavement" projects and collaborate with property owners to develop "lessons learned and benefits" communication materials to promote their benefits. If suitable existing installations do not exist, explore the development of "Green Roof", "Green Wall", "Cool Roof", "Cool Building" and "Cool Pavement" pilot projects to test and exhibit heat island mitigation strategies.
GE 3-6	Explore development of Green Roof, "Green Wall" / "Live Wall" and "vertical garden" incentives (enhanced Stormwater Credits, no-interest loans, cost sharing, etc.) to meet long-range dark impervious surface reduction goals.

Strategy GE 4

Reduce invasive species and increase climate resilience and biodiversity of City's tree canopy, parks and greenspaces.

Invasive species disrupt ecosystem balance, challenging resilience to climate change.[24] Managing invasives and promoting biodiversity strengthens ecosystems, aiding carbon absorption, providing vital services, and supporting diverse species.[25] Biodiverse ecosystems adapt better to climate shifts making them critical for the long -term health and sustainability of natural environments and greenspaces.[26]

Strategy Metrics:

Reported tree species diversity (City tree survey updates);
Percentage of native species and pollinator friendly ground cover citywide (City Ground Cover Study updates)

ACTIONS

GE 4-1	Manage forests to retain biodiversity, resilience, and ecosystem function and services in the face of climate change. Use best available science to inform fire management and planning to manage ecosystem health, community safety, and carbon storage.
GE 4-2	Map and protect areas that provide ecosystem services, such as remnant spring, wetland, and late successional forest habitats, through improved public lands management/ownership and promotion of conservation easements and private open spaces.
GE 4-3	Increase city's capacity to effectively map, monitor and remove/manage invasive species on city property. Increase in city staff personnel required in order to meet action goal.
GE 4-4	Establish a lighting control ordinance to minimize impact on native flora and fauna, and to improve night sky quality.
GE 4-5	Develop a list of commonly used landscaping plants that are invasive or potentially harmful to the ecosystem and provide a native, climate adaptive tree and plant species planting guide / recommendation list with instructional materials for removal process, soil preparation and replanting. Document and monitor the presence and spread of invasive species and encourage removal of invasive species from private lots.

Strategy GE 5

Increase connectivity, accessibility and equity of City's parks and Greenspaces.

Integrating green spaces and nature-based solutions into urban design and planning improves local ecosystem resilience.[27] Additionally, ensuring connectivity among green spaces establishes habitat corridors and enhances biodiversity in urban areas. This fosters increased gene flow and species diversity.[28]

Community members require fair access to urban greenspaces for climate resilience, health, and safety.[29] Greenspaces counterbalance heat island effects, enhance air quality, and offer vital recreational spaces promoting physical and mental well-being.[5,30 31] Ensuring all residents of Fitchburg, particularly underserved ones, access these areas boosts urban resilience and cultivates a healthier, safer community for all.[32,33]

ACTIONS

GE 5- 1	Assess whether or not to purchase and preserve greenspace in the city by quantifying the equitable, environmental, and economic benefits, along with the costs of maintaining and owning the property.
GE 5- 2	Enhance the connectivity of greenbelt and native habitat corridors across the community, including identification and improvement of "pollinator corridors" and "wildlife corridors." Prioritize green space connectivity so they are welcoming and within 10 minute walking distance of all residents, especially in underserved communities where there is a high level of impervious surfaces.

Strategy Metrics:

Share of greenspaces connected to others via habitat corridors (City Ground Cover Study updates);
Share of residents within a 10 minute walk of park (Parkscore https://www.tpl.org/parkscore)

What You Can Do

You can support the goals of the Greenspace and Ecosystems section of this Sustainability Plan as an individual, household, or a business. Here are just a few things you can do:

Make your yard rain-ready

- Plant a rain garden with native plantings to absorb storm water and replenish our aquifers.
- Replace your lawn and landscape with drought-resistant, native, non-invasive plants.
- Remove pavement and increase permeable surfaces. De-pave areas wherever possible to encourage stormwater infiltration onsite.

Support pollinators

- Make your backyard a Certified Wildlife Habitat with the National Wildlife Federation.
- Install a pollinator-friendly Green Roof (living roof) to reduce your energy consumption. Decrease heat island impacts, and reduce stormwater runoff.
- Stop the use of toxic pesticides and herbicides on your lawn and garden. If you must use pesticides and herbicides, use the lowest dose possible that is still effective, and follow all application precautions carefully.

Plant trees

- Plant native trees in your yard to provide shade and cooling in summer heat. Select trees suited for the changing climate or trees identified in the City's Urban Tree Guide.

Health and Safety

Enhancing community resilience by fostering strong community ties, robust infrastructure, and efficient systems.

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Sector Goals

by 2030:

Reduce climate **Vulnerability**

Increase infrastructure **Resilience**

Increase adaptive **Capacity**

What We Heard:

89%

of survey respondents are moderately, very, or extremely concerned about potential risks to vulnerable people from climate change impacts.

Equity Considerations:

Climate change impacts all, but its dangers aren't equally spread. As per the National Climate Assessment, specific groups—like children, older adults, low-income communities, and some communities of color—encounter higher health risks from climate effects. They can be more vulnerable to extreme heat and weather events and often lack access to resources for risk mitigation.

Equity Program Examples:

Government Programs supporting options for home cooling, such as Cooling Portland, and easily reachable public cooling facilities can safeguard at-risk households during heatwaves.[13]

Investments in green infrastructure, such as tree coverage, or initiatives like Grow Burnsville's food forests and community gardens, enhance public health by boosting air quality and cooling local neighborhoods.[14]

There is a direct relationship between human health and sustainability. Life depends on natural resources and our environment, from the air we breathe to the water we drink. Climate change exacerbates public health stressors, with higher temperatures and more intense storms endangering our well-being. These impacts affect air quality, weather patterns, food and water sources, and our interactions with our surroundings. As the climate evolves, so do the risks to human health.[1,2,3,4]

Shifts in rainfall patterns may cause increased occurrences of floods and droughts, heightening water contamination and the risk of waterborne diseases.[5,6] Droughts also raise the chances of wildfires and dust storms, worsening air quality and exacerbating respiratory conditions like asthma and allergies.[7] Rising temperatures lengthen Wisconsin's disease-carrying vector seasons, potentially increasing cases of illnesses such as West Nile virus and Lyme disease carried by mosquitoes and ticks.[8,9]

The social and economic effects of climate change may worsen mental health issues. Impacts may include stress, anxiety, and trauma arising from climate-related disasters, potentially resulting in a rise in mental health conditions.[10,11,12]

The Role of Local Governments in Climate Health and Safety

Climate change has a profound impact on public health. Just as local governments and health service providers promote healthy habits, they can also address the link between climate effects and community welfare.

Strategies on the following pages show how we achieve our sustainability goals for Health and Safety.

Actions shown for each strategy outline steps the City and community can take to support the plan goals.

Strategy Metrics indicate how we can measure our progress on each strategy.

Strategy HS 1

Assist the City's climate vulnerable population in preparing for and mitigating climate change impacts.*

* prioritized based on elevated risk sensitivities as outlined in the City's Climate Vulnerability Assessment

To optimize limited budgets, city governments should prioritize supporting vulnerable populations in building climate resilience. These groups are hardest hit by climate impacts, and enhancing their adaptive capacity cuts long-term social and economic costs. For instance, climate-induced air quality issues disproportionately affect vulnerable populations, heightening risks of respiratory conditions like asthma, especially among communities of color and low-income groups.[3,15]

The City of Fitchburg's Climate Vulnerability Assessment suggests that adaptation efforts focus on strategies that are beneficial for People of Color, those in Economic Stress, Seniors over 65, and At-Risk Workers.[16]

Strategy Metrics:

Status of cooling center availability;
Availability of Emergency Response Toolkit

ACTIONS

HS 1-1	Collaborate with partners to establish cooling centers in air-conditioned public facilities (e.g., senior centers, libraries), with an emphasis on locations that maximize accessibility by vulnerable populations (i.e., those with limited mobility or lack of access to private vehicles).
HS 1-2	Develop a plan to improve bus stop shelters' ability to provide relief from extreme heat (e.g., reflective materials, cooling fans).
HS 1-3	Develop citywide policies to encourage, incentivize, or require the reduced use of phosphorus and synthetic nitrogen fertilizers, herbicides and pesticides, that have negative impacts on natural resources and human health.
HS 1-4	Build City staff capacity to support community-led, neighborhood-focused resilience actions (e.g., identifying best practices, establishing resilience hubs and implementing neighbor-based emergency response).
HS 1-5	Support and expand a social vulnerability assessment to more effectively respond to diverse neighborhoods and households that are most at risk during emergency situations. Enhance interagency data sharing to increase response capacity across the city.
HS 1-6	Collaborate with Dane County and other partners to work with vulnerable populations to create specific adaptation strategies to address public health risks.
HS 1-7	Conduct a community-wide assessment of the potential health impacts of climate change on Fitchburg residents, identifying the neighborhoods, groups, and individuals most vulnerable to climate change and specific opportunities for the city to reduce vulnerability among specific groups.
HS 1-8	Collaborate with partners to create or promote an existing Emergency Response Toolkit offering tips and suggestions for residents to increase their emergency preparedness, and make it widely available to City residents.

Strategy HS 2

Educate, engage, and empower the public about the health and safety risks of climate change impacts, and offer guidance for mitigating those risks.

Education is crucial for driving climate action, empowering individuals to combat the climate crisis. Studies show climate education can cut emissions and reduce vulnerability to environmental hazards.[17,18,19] Effectively reducing climate change as a public health risk demands prevention strategies, including education and outreach. These efforts can influence behavior to prevent and alleviate the community-wide impact of climate change, especially on Fitchburg's most vulnerable communities.

Strategy Metrics:

Status of education, outreach, and communication implementation

ACTIONS

HS 2-1	Coordinate with Public Health Madison & Dane County (PHMDC) to provide up-to-date information to residents about the health effects of heat and Cooling Center locations throughout the County.
HS 2-2	Provide education and resources about climate risks to the public, especially those most vulnerable to potential impacts of high-heat and extreme weather, translated to the City's top non-English languages, via communication platforms typically relied upon for information by those populations.
HS 2-3	Emphasize steps individuals can take to improve emergency preparedness. Increase awareness of City and other alert systems.

Strategy HS 3

Ensure that mission critical emergency services and health care facilities within the City are prepared for impacts of climate change.

Mission-critical facilities, emergency facilities, healthcare, and infrastructure are crucial for community resilience. Their vulnerability during extreme weather can have serious consequences and hamper needed support. Preparing these assets for climate impacts minimizes risks, sustains services, safeguards vulnerable groups, and saves lives. Ensuring resilience of these services also illustrates proactive governance, fosters public trust, and encourages community engagement in climate efforts.

Strategy Metrics:

Status of resilience plan and implementation

ACTIONS

HS 3-1	Collaborate with partners to conduct a needs assessment of accessible community centers for extreme weather or other emergency situations. Create a development improvement plan, if needed.
HS 3-2	Assess City infrastructure and prioritize support for properties that provide services to vulnerable populations to ensure they are accessible.
HS 3-3	Update or develop a community resilience plan to prioritize and prepare for responses in the event of a disaster and extreme weather events. Identify the location of critical facilities including hospitals, medical service providers, senior homes, childcare facilities, shelters, major and alternate transportation routes, public transit facilities and locations where hazardous chemicals are used or stored.
HS 3-4	Ensure that facilities that serve vulnerable populations are resilient to climate hazards. Develop model procedures for ensuring both City and non-City facilities employ best practices in the event of an emergency such as flooding, power outages, extreme heat, etc.
HS 3-5	Engage the business and health care community in developing emergency response plans and business continuity plans.

Strategy HS 4

Strengthen non-governmental community response capacity and social support networks.*

* communities of faith, senior center, food pantries, condo associations, social networks, etc

Research suggests that social networks play a vital role during stressful times, facilitating collective action and communication.[34] Connected communities are better equipped to manage climate risks, cope with severe weather, and capitalize on potential benefits from changing conditions. Some studies even suggest that community support may be as critical, if not more so, than emergency services.[34]

For instance, research on the 1995 Chicago heat wave highlights the importance of social networks; individuals with connections were less susceptible to heat-related deaths.[35] Based on this, Fitchburg can mitigate community vulnerabilities to climate impacts by fostering enhanced social connectivity.

ACTIONS

HS 4- 1	Review and evaluate community networks and connections for those who require special attention or assistance during or after extreme weather events (heat, cold, and heavy precipitation). Develop a Resilience Contact List for the City and any community partners, updated annually, to be utilized during times of distress.
HS 4- 2	Enhance community networks and connections for those who require special attention, such as the elderly, homebound, disabled, isolated, or those likely to be in need of financial assistance during or after extreme weather events (heat, cold and heavy precipitation).
HS 4- 3	Collaborate with community partners to develop mutual aid networks or "buddy" programs to identify vulnerable individuals, check on them during extreme climate or weather events, and connect them to food, water, and other necessities.

Strategy Metrics:

Status of Resilience Contact List;
Status of community partner mutual aid networks

What You Can Do

You can support the goals of the Health and Safety section of this Sustainability Plan as an individual, household, or a business. Here are just a few things you can do:

Make your home resilient

- Put together an emergency preparedness kit for your household.
- Prepare your home for the extremes. Understand the risk of extreme weather, extreme temperatures, flooding or wildfire to your home, and take action to safeguard your home.
- Plan and rehearse a fire evacuation plan with everyone who lives in your home or apartment.
- Have breathing-protection masks available for you and your family for when air quality alerts are declared.
- Take first-aid and CPR certification training.

Make your community resilient

- Get involved with a local Community Emergency Response Team (CERT) and receive training to prepare for potential disasters.
- Adopt-a-Neighbor: Notice a person who may be vulnerable or who lives alone. Offer to check on them periodically, especially during extreme weather or a natural disaster.
- Locate your local community resilience hub or cooling center.

Sustainable Economy

Fostering Fitchburg's economic growth by prioritizing new sustainable enterprises and fair workforce advancement, while increasing resilience and addressing climate change.

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Sector Goals

by 2030:

Develop economic **Potential**

Support equitable **Workforce** development

Increase local business **Resilience**

Prepare for and guide climate migration

Equity Considerations:

Climate action generates jobs and promotes equity. Marginalized groups are most affected by climate impacts but benefit least economically. Ensuring green jobs are inclusive and accessible is essential.

Investing in renewables, energy efficiency, and public transit creates local jobs with fair wages. Savings from these measures lower living costs, easing financial burdens. Strategic climate action supports equitable economic growth.

Equity Program Examples:

Job Training: Programs such as Asheville NC's Green Opportunities help marginalized individuals find sustainable jobs by providing technical training, life skills, industry credentials, and personalized support.[1]

Green Business Startup: The Santa Fe Business Incubator supports green startups with affordable workspace, mentoring, and funding opportunities, focusing on diverse, including women and minority, entrepreneurs.[2]

Initiatives for Affordable Green Housing: PUSH Buffalo and similar initiatives combine climate and housing goals to tackle equity disparities and improve access to renewable energy.[3]

Sustainability and the economy are closely linked. For example, unaddressed human-induced climate change could cost the U.S. billions by century's end. Studies suggest the economic difference between mid-range (RPC6) and high-range (RPC8.5) climate models could reach $224 billion yearly by 2090.[4] Another study found future annual economic impacts from climate change might be four times higher than COVID-19's global economic impact.[5] Taking climate action now can avoid future costs, referred to as the Social Cost of Carbon or Avoided Cost of Carbon. In Fitchburg, this cost is at least $16.50 per metric ton based on county climate impacts, while Wisconsin legislators proposed an initial cost of $50 in Assembly Bill 766.[6,7,8]

Economic Savings and Development

Investing in energy efficiency, public transportation, renewable energy, and various climate strategies saves money for community businesses and residents.[9,10,11] These savings enhance residents' quality of life and are likely spent locally, adding to the city's economy. Moving away from fossil fuels keeps more wealth within the community, creating local jobs. Additionally, many job opportunities in sustainability and climate action shift funds from less labor-intensive, resource-heavy sectors to those supporting greater employment and lower resource use.[12,13]

Strategies on the following pages show how we achieve our sustainability goals for Sustainable Economy.

Actions shown for each strategy outline steps the City and community can take to support the plan goals.

Strategy Metrics indicate how we can measure our progress on each strategy.

Strategy SE 1

Grow the City's economy through increasing economic development focused on the "Green Economy".

Sustainability and climate action require significant investment in the next 15 years to achieve goals and avoid long-term economic harm. However, these investments can stimulate growth. Advancing sustainability could generate a $26 trillion economic gain in the US by 2030 compared to the status quo.[14] On average, every $1 invested in resilience returns $4 in benefits.[15] Studies show strong sustainability initiatives can help communities "build back better" from COVID while creating long-term economic potential. Supporting climate action offers economic development opportunities, especially for proactive communities.

Strategy Metrics:

City employment and firm counts;
City tax base data;
City building permits;
Bureau of Labor Statistics GDP Data

ACTIONS

SE 1-1	Explore opportunities to broaden the City's economic base with diversification initiatives, such as targeting the development of emerging clusters or industries that (a) build on the region's unique assets and competitive strengths; and (b) provide stability during downturns that disproportionately impact any single cluster or industry.
SE 1-2	Foster small business and green business development, particularly those which increase renewable energy, climate mitigation and adaptation resources within the community.
SE 1-3	Conduct, or collaborate on a Sustainable Economy Development Assessment to identify the economic and business growth potential of the "Green Economy" and businesses offering the goods and services that align with the goals of this plan within Fitchburg, the metro area, or beyond. Examples of potential goods and services include renewable energy designers and installers, energy efficiency renovation specialists, landscapers focused on native plants, and potentials in emerging technologies such as green hydrogen or eHydrogen. Study to include identification of opportunities to advance economic opportunities for the City's vulnerable, low-income, youth, and under-employed populations.

Strategy SE 2

Support equitable workforce development and entrepreneur opportunities of sustainability in the economy. Achieve a 5% increase in employment by 2030.*

* 600 new "green" jobs

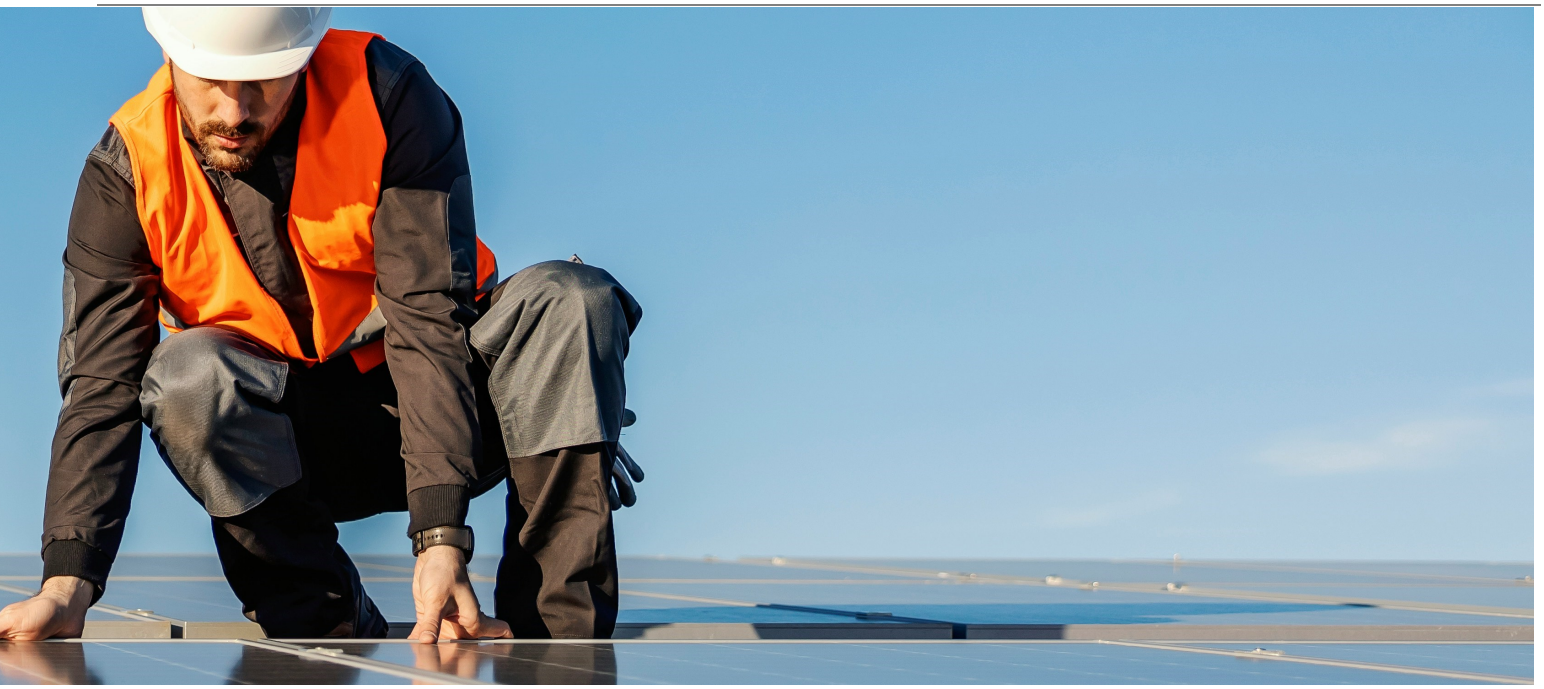
Local sustainability actions, like distributed solar and weatherization, create quality green jobs that stay within communities.[18] These jobs which are vital for a carbon-free economy offer higher and more equitable wages than the national average.[18] Many green jobs have lower barriers to entry, providing better wages for nearly half of workers with only a high school diploma. However, these jobs require scientific and technical skills, offering opportunities to gain valuable skills for the local workforce.[18] Preparing the workforce for a sustainable economy can enhance economic potential for disadvantaged individuals and build community resilience.[19,20]

Strategy Metrics:

Status of job training programs supporting Fitchburg residents;
Employment counts within green-related industries (US Census, OnTheMap)

ACTIONS

SE 2-1	Partner with State and County waste management and local and regional recycling centers to establish or support the establishment of a program to encourage and promote new entrepreneurial businesses advancing the use of recycled material feed stock, the utilization of organics composting, and "Circular Economy" concepts which further the goals of this plan. Explore the potential of grants to support program establishment.
SE 2-2	Collaborate with partners such as Madison College Renewable Energy Program, Boys and Girls Club McKenzie Regional Workforce Center, Wisconsin Electrical Apprenticeship & Training (wijatc.org) to identify existing or planned green job training and entrepreneurial development programs and regularly promote awareness of them among Fitchburg residents, particularly among youth and vulnerable and underserved populations.
SE 2-3	Promote alternatives to traditional building demolition such as relocation, deconstruction and salvage. Establish an education program focused on building workforce with deconstruction skills and capacities.
SE 2-4	Collaborate with institutions, organizations, and businesses in the community to support and promote awareness of "green job" openings and recruitment opportunities. Support organizations not yet focusing on green job recruitment in learning how they may participate in increasing the sustainable economy in Fitchburg.



Strategy SE 3

Support local business operations in increasing their sustainability and building resilience in the face of climate change.

Studies indicate future annual economic impacts from climate change might be four times higher than COVID-19's global economic impact.[5] Small local businesses, which generate 44% of economic activity and most new jobs, are vulnerable to these impacts. Increasing the sustainability and resilience of local businesses benefits owners, employees, households, and the broader community.[25,24]

Strategy Metrics:

Status of emergency management plan implementation and inclusion of climate vulnerability considerations

ACTIONS

SE 3-1	In all economic development endeavors the City participates in, encourage "green" businesses that are non-polluting, offer or support environmentally sustainable goods or services, and/or actively promote telecommuting, alternative work schedules, and alternative transportation modes.
SE 3-2	Address the recommendations from the Fitchburg Climate Risk and Vulnerability Assessment, Emergency Management Plan, and State climate change data in order to prepare for the increased demands from climate change with a specific emphasis on water, road, utilities, and other public infrastructure.

Strategy SE 4

Establish sustainable financing for plan implementation.

Resilience projects often incur upfront costs for future gains or prevent environmental harm without immediate profits. Current subsidies, including Federal Inflation Reduction Act funding, and tax powers might not fully cover all early climate adaptation efforts, or available funds may not align with usual methods. Communities are exploring new funding options like climate bonds and public-private partnerships.[30] Some are establishing sustainability or Climate Funds and emissions trading to finance their climate resilience needs creatively.[31]

Strategy Metrics:

Ongoing inclusion of Sustainability Plan implementation in City operational budget

ACTIONS

SE 4-1	Establish and maintain a database or awareness of federal funding, incentives, and grants available to support plan implementation resulting from the Inflation Reduction Act (IRA), Infrastructure Investment and Jobs Act (IIJA) and others. Grant opportunities may include funding for municipal led projects or initiatives as well as funding that can be made available to community members and businesses as incentives in support of plan goals. Explore opportunities for grant submissions, including collaboration with other communities or entities.
SE 4-2	Collaborate with partners to explore the potential of using Inflation Reduction Act funding to establish a Green Bank to support affordable energy efficiency, renewable energy, and other investments by community members and businesses in alignment with this plan.
SE 4-3	Capture savings from City facility energy efficiency and renewable energy projects. Create a special Sustainability Fund for implementing future projects in alignment with this Plan, into which those operational savings and performance-based rebate checks can be directed.
SE 4-4	Explore the potential of collaborations with donors, philanthropists, and non-profit foundations to develop a Sustainability Action and Equity Fund for the City of Fitchburg.

What You Can Do

You can support the goals of the Sustainable Economy section of this Sustainability Plan as an individual, household, or a business. Here are just a few things you can do:

Support sustainable businesses

- Shop at small, locally owned businesses.
- Support businesses that have transparent and sustainable practices.
- Talk to your children about sustainability and how we can all be more sustainable in our daily lives – including our purchases and businesses we support.

Explore opportunities

- Explore opportunities for a climate solutions career, a job in climate tech, sustainability, social impact, or learn more about sustainable career pathways.
- Access entrepreneurship resources through the US Small Business Administration and the State of Wisconsin to learn how to start a small business.
- Explore opportunities for funding support through the EPA's Clean Communities Investment Accelerator .

Make your business resilient

- Access information on sustainable business practices through resources like the State of Wisconsin DNR, MIT, University of New Hampshire, or the Green Business Benchmark.
- Create a Disaster Preparedness Plan or Preparedness Toolkit for your business.

Implementation and Cross Pollinating Actions

Cross Pollinating Actions are fundamental or organizational suggestions that are applicable across all, or multiple sectors.

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The initial years following the adoption of the Sustainability Plan are crucial for its success. Establishing clear internal and external roles and securing funding are essential steps in the implementation phase, ensuring the community stays on track to achieve its goals. This plan sets ambitious targets for improved sustainability, substantial reductions in greenhouse gas (GHG) emissions, and enhancing community resilience. Achieving this vision necessitates a strong commitment to integrating the Sustainability Plan into all aspects of municipal operations, functions, and services.

Implementation is For Everyone

The sustainability concerns and impacts that are the focus of this plan are broad. Solving them must be equally broad. Some actions will need to be led by the City of Fitchburg's elected officials, leaders, or City departments while others can only be supported by local government and require engagement by individuals, families, or the business community through the choices they make. Achieving a better and more resilient future for Fitchburg will require commitment from both city leaders and the community.

Sustainability Implementation is a Journey

Starting a multiple-year plan involves uncertainties, particularly concerning future technologies, and opportunities. Recognizing this, the Sustainability Plan will be managed through annual implementation plans, which will identify prioritized actions from all sectors to be initiated each year. This approach allows plan implementation to be integrated into annual work and budget planning for all departments, ensuring ongoing alignment and integration with other City efforts.

We expect that detailed actions will be refined as they are implemented. Therefore, these actions are designed to provide guidance on intent while allowing flexibility in specifics and design. Actions that may involve modifying or creating policies or ordinances, or that may incur city expenses, should be anticipated to go through the City Council approval process as they are implemented.

Implementation Support Tools

To support the City in its initial implementation phase, the paleBLUEdot team has created tools to support implementation:

Implementation and Monitoring Matrix:
Excel based tool supporting action implementation and monitoring.

Example Programs, Policies and Ordinances
The paleBLUEdot team has assembled example programs, policies and ordinances supporting some of the strategies and actions included in the City's Sustainability Plan. The examples can be found on the following webpage:

https://palebluedot.llc/fitchburg-example-policies

Strategy CP 1

Organize for Sustainability Plan implementation.

Incorporating actions from the Sustainability Plan into everyday operations is important for effectively executing the plan and achieving enduring sustainability objectives. Forming an implementation team with members from all City divisions, designating personnel to oversee or engage in actions, and instituting a system to assess implementation advancement will facilitate the integration of sustainability into City operations.

ACTIONS

CP 1-1	Establish a City "Green Team" comprised of staff representatives from all key City departments. The task of the Green Team should be to meet regularly to support the initial and ongoing prioritization and implementation of annual implementation actions and projects and to support reporting and progress updates.
CP1-2	The City Administration will work with City Green Team and staff to develop annual implementation plans that specify a work sequence and timeline for implementation tasks, estimate necessary funding and staffing resources, and outline an accountability process, to be presented to the Resource Conservation Commission and City Council for comment and approval coordinated with the city's annual budgeting process. Progress updates will be reported to the Resource Conservation Commission and City Council on a regular basis.
CP1-3	Establish clear guidance and direction for the participation in and support of the Sustainability Plan implementation actions by all City of Fitchburg departments. Encourage continuing education of municipal staff relevant to Sustainability Plan actions.
CP1-4	Establish and implement a policy to review existing and future City of Fitchburg policy and ordinance changes against the goals, strategies, and actions of this Sustainability Plan to ensure alignment of changes with this plan.
CP1-5	Fund and support environmental and sustainability staffing required to: •Facilitate discussion among large users to reduce emissions through business and industrial strategies. •Participate in technical resource programs as they are available through County, Regional, State, Federal, and non-profit provider partners. •Support City of Fitchburg department managers and staff as they implement Sustainability Plan actions within their service area or area of expertise. •Convene the internal City of Fitchburg Green Team. •Ensure the establishment and maintenance of a City of Fitchburg Sustainability webpage supporting plan resources for the community. •Coordinate and organize volunteer groups and events. •Engage City boards and commissions to ensure the Sustainability Plan is integrated into their work plans.
CP1-6	Provide access to training for City staff, commissioners, and city council members in Health in All Policies principles to ensure that decision-makers are informed about the health, equity, and sustainability consequences of various policy options during the policy development process.
CP1-7	Review Sustainability Plan implementation progress and impacts on a regular basis (1-2 year cycle). Review should include development of an updated community-wide and municipal operations GHG inventory. Strategies and actions should be reviewed for implementation progress and for continued appropriateness. Based on the review, adjust, add, and remove detailed Sustainability Plan actions as appropriate.

Strategy CP 2

Facilitate and collaborate with external support needed for Sustainability Plan implementation.

Sustainability plans with citywide objectives need engagement from and involvement of stakeholders across the community. Consequently, plan execution must be, and can be, a joint effort. Establishing a comprehensive and coordinated community communication plan, coordinating partnerships with other agencies and community groups to aid in action implementation are key to creating coordinated involvement. Meanwhile, mobilizing volunteers can significantly expand the impact of the City's implementation efforts.

ACTIONS

CP 2-1	Continue and expand sustained outreach and engagement efforts that seek to build and maintain direct relationship with under-resourced, traditionally marginalized, and climate vulnerable communities within Fitchburg.
CP 2-2	Identify an existing commission to act as a primary community member body to support the implementation of the Sustainability Plan. Commission's annual work plans should include support of the implementation of the Sustainability Plan; supporting City staff in any relevant departments; receiving updates on City Sustainability Plan projects and progress; being provided with opportunity to comment on identification of annual Sustainability Plan implementation priorities, projects, and budgets; and providing input on plan adjustments as needed.
CP 2-3	Establish a coordinated annual communication and education campaign supporting the communication and educational needs of each of the Sustainability Plan sectors. Include development of resources and information on the City's website and enlist groups and organizations in supporting distribution of information.
CP 2-4	Assemble a group of Sustainability Champion volunteers to promote community engagement in the actions of this plan and share information and resources at local events through tabling and presentations. Topics and resources to include energy efficiency, sustainable transportation, native grasses and trees, sustainable gardening and food options, and others relevant to the goals of the plan.
CP 2-5	Establish jurisdictional partnerships that advance Sustainability Plan strategies to advance and accelerate action. This can include government entities like Dane County, the State of Wisconsin; utilities like MGE and Alliant; institutions like UW-Madison, Oregon and Verona School Districts; Fitchburg businesses, and community groups.
CP 2-6	Establish and maintain a Fitchburg Green Corps volunteer group to help support Sustainability Plan action implementation and communications.

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Appendix A
Supporting Research

Sustainability Baseline Study

To support the Fitchburg Sustainability Plan planning team members, the paleBLUEdot team assembled the Sustainability Baseline Study. This document provided a review of a wide range of community-wide metrics, data, and comparisons against city peer communities for each of the plan sectors included in this report. The document also included preliminary sector specific draft strategic goal recommendations for the planning team to consider, discuss, and revise at the beginning of the planning team effort.

Click on the link below to access the document:
https://www.fitchburgwi.gov/DocumentCenter/View/27102/City-of-Fitchburg-Sustainability-Baseline-and-Reduction-Recommendations-112923

Climate Vulnerability Assessment

At the beginning of the planning effort, the paleBLUEdot team developed a Climate Vulnerability Assessment for the City of Fitchburg. The assessment included the identification of vulnerable populations within the community and possible impacts and risks associated with projected climate change for the city. paleBLUEdot mapped the vulnerable populations within the city as well as existing infrastructure and resources which may be capable of supporting climate adaptation strategies. These assessments provided a basis for understanding vulnerabilities and resources which supported the decision making process needed for identifying and prioritizing climate adaptation measures to be included in the final plan. The Assessment focused on citywide vulnerabilities with a particular focus on climate vulnerable populations to ensure all populations benefit from proposed implementation measures.

Click on the link below to access the document:
https://www.fitchburgwi.gov/DocumentCenter/View/27101/City-of-Fitchburg-Vulnerability-Assessment-111923

Citywide GHG Inventory

The paleBLUEdot team compiled a citywide Greenhouse Gas Inventory. The assessment included collection of raw data and calculation of greenhouse gas emissions for each of the primary emissions sectors included in this plan. The inventory included both communitywide emissions as well as municipal operations. The report included citywide emissions comparisons against communities within the region.

Click on the link below to access the document:
https://www.fitchburgwi.gov/DocumentCenter/View/27098/City-of-Fitchburg-GHG-Inventory-112023

Citywide Ground Cover, Tree Canopy and Carbon Sequestration Study

paleBLUEdot conducted a baseline assessment of citywide ground cover and tree canopy extent. The study identified ground cover conditions (grass, water, wetland, tree canopy) citywide as well as by census tract. Based on the groundcover data, calculations were made for annual carbon sequestration rates, carbon stock, tree canopy/green space economic value, and pollution absorption rates (CO, O_3, NO_2, SO_2 particulate pollution).

Included in this assessment was an assessment of citywide heat island characteristics and conditions. The study identified impervious surface conditions and coverage (sidewalks, roadway, parking, and building) and compiled data in subcategories of light reflective and light absorbent conditions. Baseline calculations were made for overall heat island contribution coefficient by neighborhood (expressed as summer night time degrees F above natural conditions, calculations based on research and formulas compiled by the University of Minnesota and Minnesota State University).

Click on the link below to access the document:
https://www.fitchburgwi.gov/DocumentCenter/View/27099/City-of-Fitchburg-Ground-Cover-Survey-and-Sequestration-Study-112923

Citywide Renewable Energy Potentials Study

In support of development of effective renewable energy goalsetting and to establish strategies addressing renewable energy development, paleBLUEdot conducted a citywide solar pv potentials study including economic and environmental benefits. This effort included:

1) Collect community-wide satellite data (NREL, NOAA, and NASA data).
2) Determine building roof stock characteristics and solar suitable buildings, calculate total suitable areas by roof configuration/orientation.
3) Calculate total rooftop solar capacity and annual energy generation by roof configuration/orientation.
4) Identify cost efficient annual energy generation potential.
5) Research solar market at national, State and regional levels. Identify low, medium, and high solar market absorption rates and citywide solar pv goals.
6) Identify environmental and economic benefit of solar including economic development and job creation potential. (NREL JEDI model)
7) Develop citywide Renewable Solar Energy Potentials report.

Click on the link below to access the document:
https://www.fitchburgwi.gov/DocumentCenter/View/27100/City-of-Fitchburg-Renewable-Potentials-Study-112923

Appendix B

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Potential Cumulative Community Cost and Savings From Plan Implementation

The following documents the calculations and source references used for estimating the potential cumulative communitywide cost savings of the actions included in the Sustainability Plan.

Summary of Estimated Cumulative Savings of Modeled Reductions
City of Fitchburg

Notes

Transportation

VMT Reductions (public transit, bike, walk, etc)

Formula:

Cumulative vehicle miles saved x Average vehicle operation cost per mile = Gross VMT savings

	VMT saved (goal year)	13,264,126
	Cumulative vehicle miles saved (through goal year):	46,424,441
1	Average vehicle operating cost per mile:	$0.810
	Gross VMT savings	**$46,424,441**

1 Savings per VMT based on AAA estimates https://newsroom.aaa.com/wp-content/uploads/2023/08/YDC-Fact-Sheet-FINAL-8.30.23-1.pdf , https://www.slashgear.com/aaa-says-it-costs-about-74-cents-per-mile-to-drive-23496316/ https://www.thesimpledollar.com/save-money/is-it-really-cheaper-to-ride-the-bus/

Increased Public Transit Use

Formula:

Cumulative increased public transit mileage x Average public transit cost per mile = Increased spending on public transit

	Increased public transit miles (goal year)	5,305,650
	Cumulative increased public transit miles (through goal year):	18,569,776
2	Annual increased public transit pass costs (goal year):	-$240,505
	Cumulative increased public transit pass costs (through goal year):	-$841,768
	Increased spending on public transit	**-$841,768**

2 Annual increased public transit pass costs calculated based on increased percentage of population using public transit (target increased public transit percentage) multiplied by cost of monthly transit pass. Negative numbers indicate increased consumer spending. https://www.census.gov/programs-surveys/sis/resources/data-tools/quickfacts.html https://www.cityofmadison.com/epayment/metro/buspass/

EV and Alt Fuel Conversions

Formula:

Cumulative VMT converted to EV/alt fuel x Average vehicle operation cost savings per mile = Gross EV VMT savings - Gross EV purchase spending difference = Net EV VMT Savings

	VMT converted to EV/Alt fuel (goal year)	13,264,126
	Cumulative VMT converted to EV/alt fuel (through goal year)	46,424,441
3	Average fuel savings per mile:	$0.117
4	Average vehicle maintenance savings per mile:	$0.040
	Cumulative Gross EV VMT savings (through goal year)	$7,305,865
5	Spending difference per vehicle on EV purchase vs ICE purchase	-$277
	New electric vehicle purchases	4,107
	Gross EV purchase spending difference (through goal year)	-$1,137,715
	Net EV VMT savings	**$6,168,150**

3 Fuel Savings per VMT based on average reported gasoline costs (https://gasprices.aaa.com/state-gas-price-averages/) divided by current average MPG (Federal Highway Administration: https://www.fhwa.dot.gov/policyinformation/quickfinddata/qftravel.cfm) compared against average fuel cost per mile using current kWh rate (https://www.electricitylocal.com/) and average kWh/100 mile data (https://www.fueleconomy.gov/feg/byfuel/EV2024.shtml ; https://ev-database.org/cheatsheet/energy-consumption-electric-car')

4 Maintenance savings per mile based on US Department of Energy FOTW #1190, June 14, 2021: Battery-Electric Vehicles Have Lower Scheduled Maintenance Costs than Other Light-Duty Vehicles: https://www.energy.gov/eere/vehicles/articles/fotw-1190-june-14-2021-battery-electric-vehicles-have-lower-scheduled

5 Average EV purchase price increse per vehicle on Kelly Blue Book average EV purchase price compared to average gasoline vehicle purchase price (https://www.kbb.com/car-advice/electric-car-faqs/) with an average of $3,750 in tax credits appied (tax credits are available up to $7,500 for qualifying vehicles) Total cost difference is then divided by an assumed 5 year financing term to arrive at an estimated annualized cost difference. Negative numbers indicate increased consumer spending https://www.nerdwallet.com/article/taxes/ev-tax-credit-electric-vehicle-tax-credit

Potential Total Cumulative Transportation Cost Savings

Formula:

Transportation sector savings - Transportation sector cost increases = Potentail Total Cumulative Transportation Cost Savigns

Transportation Sector Savings	
Gross VMT savings	$46,424,441
Gross EV VMT savings	$7,305,865
Total Gross Transportation Savings	$53,730,306
Transportation Sector Cost Increases	
Increased spending on public transit	-$841,768
Gross EV purchase spending difference	-$1,137,715
Total Gross Transportation Cost Increases	-$1,979,483
Potentail Total Cumulative Transportation Cost Savings	**$51,750,822**

Summary of Estimated Cumulative Savings of Modeled Reductions
City of Fitchburg

Energy - Residential

Notes

Residential Savings - grid electricity to customer owned solar

Formula:

Cumulative kWh converted to solar x Average cost savings per kWh = Residential solar savings

	Residential kWh converted (goal year)	4,600,614
	Cumulative residential kWh converted (through goal year)	16,102,149
	Average net solar cost savings per solar kWh	$0.092
6a	Average solar installation cost per KW	$3,116.50
7	Average kWh produced annually per solar pv KW installed	1,287
	Estimated installed solar PV KW installed (goal year)	3,575
	Estimated total solar installation costs	$11,140,492
8	Est average lifespan kWh produced per solar pv KW installed	38,429
8	Estimated cumulative lifespan kWh produced	137,371,460
9	Estimated value of cumulative lifespan kWh produced	$23,761,279
	Average solar cost savings per kWh produced	$0.092
	Residential solar savings	**$1,479,360**

6a Recent average cost per KW is 1000x the per watt cost reported by Solar Reviews https://www.solarreviews.com Value includes assumed financing costs bsaed on 20% initial payment and 80% financed through 10 year loan with 3.5% annual interest rate. Potential savings from tax credits, depreciation, or grants are not included and would reduce these costs.

7 Calculations are based on the geographic energy production factor (https://www.nrel.gov/docs/fy04osti/35297.pdf) multiplied by an average performance ratio of 78% (https://www.nrel.gov/docs/fy13osti/57991.pdf)

8 Based on an assumed average useful life of 32.5 years according to NREL research (https://www.nrel.gov/analysis/tech-footprint.html) with an average degradation rate of 0.5% (https://www.nrel.gov/state-local-tribal/blog/posts/stat-faqs-part2-lifetime-of-pv-panels.html)

9 Svings per kWh based on average electricity cost per kWh (https://www.electricitylocal.com/) calculated to the solar array's midlife (year 16) using an estimated average electrical cost inflation of 2% annually

Residential Savings - community solar

Formula:

Cumulative kWh converted to community solar x Average cost savings per kWh = Residential community solar savings

	Residential kWh converted (goal year)	0
	Cumulative residential kWh converted (through goal year)	0
10	Average community solar cost savings per kWh	$0.013
	Residential solar savings	**$0**

10 The average cost savings per kWh of community solar subscription is estimated at 10%.

Residential Savings - utility purchased renewable

Formula:

Cumulative kWh converted to utility purchased renewable x Average cost/savings per kWh = Residential utility purchased cost/savings

	Residential kWh converted (goal year)	4,600,614
	Cumulative residential kWh converted (through goal year)	16,102,149
11	Average utility purchased cost/savings per kWh	-$0.013
	Residential utility purchased cost/savings	**-$204,336**

11 The average cost/savings per kWh of utility purchased renewable energy subscription is based on utility fee information. Negative numbers indicate increased consumer spending

Residential Savings - electrical energy efficiency

Formula:

Cumulative kWh saved from energy efficiency x Average cost per kWh = Gross Residential electrical energy efficiency savings - Residential Efficiency Upgrade Costs = Net Residential Electrical Energy Efficiency Savings

	Residential kWh saved (goal year)	6,440,860
	Cumulative residential kWh saved (through goal year)	22,543,009
12a	Average cost per kWh	$0.126
	Gross Residential electrical energy efficiency savings	**$2,840,419**
13	Residential Electrical Efficiency Upgrade Costs	-$2,499,569
	Net Residential Electrical Energy Efficiency Savings	**$340,850**

12a Energy efficiency savings per kWh saved based on average electricity cost per kWh: https://www.electricitylocal.com/

13 Assumed energy efficiency upgrade costs are calculated assuming an average ROI of12% (https://www.aceee.org/blog/2019/05/existing-homes-energy-efficiency) Negative numbers indicate increased consumer

Residential Savings - natural gas energy efficiency

Formula:

Cumulative therms saved from energy efficiency x Average cost per therm = Gross Residential natural gas energy efficiency savings - Residential Natural Gas Efficiency Upgrade Costs = Net Residential Electrical Natural Gas Efficiency Savings

14	Residential therms saved (goal year)	456,261
14	Cumulative residential therms saved (through goal year)	1,596,913
15	Average cost per therm	$0.996
	Gross Residential natural gas energy efficiency savings	**$1,590,526**
14, 16	Residential Natural Gas Efficiency Upgrade Costs	-$1,399,663
	Net Residential Electrical Natrual Gas Efficiency Savings	**$190,863**

14 Includes fuel switching from fossil fuel heat to electric

15 Energy efficiency savings for natural gas is based on average natural gas cost per therm https://naturalgaslocal.com/

16 Assumed energy efficiency upgrade costs are calculated assuming an average ROI of12% (https://www.aceee.org/blog/2019/05/existing-homes-energy-efficiency) Negative numbers indicate increased consumer spending

Potential Total Cumulative Residential Energy Cost Savings

Formula:

Residential solar savings + Residential community solar savings + Residential utility purchased renewable + Residential electrical efficiency savings + Residential natural gas energy efficiency savings - Residential increased electrical costs = Potential Total Cumulative Residential Energy Savings

Residential solar savings	$1,479,360
Residential community solar savings	$0
Residential utility purchased renewable cost/savings	-$204,336
Residential electrical efficiency savings (net)	$340,850
Residential natural gas energy efficiency savings (net)	$190,863
Potentail Total Cumulative Residential Energy Savings	**$1,806,737**

Summary of Estimated Cumulative Savings of Modeled Reductions
City of Fitchburg

Notes

Energy - Non Residential

Non-Residential Savings - grid electricity to solar

Formula:

Cumulative kWh converted to solar x Average cost savings per kWh = Non-Residential solar savings

	Non-Residential kWh converted (goal year)	12,015,566
	Cumulative Non-Residential kWh converted (through goal year)	42,054,480
	Average solar cost savings per kWh	$0.080
6b	Average solar installation cost per KW	$1,978.00
7	Average kWh produced annually per solar pv KW installed	1,287
	Estimated installed solar PV KW installed (goal year)	9,336
	Estimated total solar installation costs	$18,466,813
8	Estimated average lifespan kWh produced per solar pv KW installed	38,429
8	Estimated cumulative lifespan kWh produced	358,777,281
9	Estimated value of cumulative lifespan kWh produced	$47,315,170
	Average solar cost savings per kWh produced	$0.080
	Non-Residential solar savings	**$3,381,492**

6b Recent average cost per KW is 1000x the per watt cost reported for commercial solar arrays by NREL https://www.nrel.gov/docs/fy21osti/77324.pdf https://www.nrel.gov/solar/market-research-analysis/solar-installed-system-cost.html Value includes assumed financing costs bsaed on 20% initial payment and 80% financed through 10 year loan with 3.5% annual interest rate. Potential savings from tax credits, depreciation, or grants are not included and would reduce these costs.

7 Calculations are based on the geographic energy production factor (https://www.nrel.gov/docs/fy04osti/35297.pdf) multiplied by an average performance ratio of 78% (https://www.nrel.gov/docs/fy13osti/57991.pdf)

8 Based on an assumed average useful life of 32.5 years according to NREL research (https://www.nrel.gov/analysis/tech-footprint.html) with an average degradation rate of 0.5% (https://www.nrel.gov/state-local-tribal/blog/posts/stat-faqs-part2-lifetime-of-pv-panels.html)

9 Svings per kWh based on average electricity cost per kWh (https://www.electricitylocal.com/) calculated to the solar array's midlife (year 16) using an estimated average electrical cost inflation of 2% annually

Non-Residential Savings - community solar

Formula:

Cumulative kWh converted to community solar x Average cost savings per kWh = Non-Residential community solar savings

	Non-Residential kWh converted (goal year)	0
	Cumulative Non-Residential kWh converted (through goal year)	0
10	Average solar cost savings per solar kWh	$0.01
	Commercial solar savings	**$0**

10 The average cost savings per kWh of community solar subscription is estimated at 10%.

Non-Residential Savings - utility purchased renewable

Formula:

Cumulative kWh converted to utility purchased renewable x Average cost/savings per kWh = Non-Residential utility purchased cost/savings

	Non-Residential kWh converted (goal year)	12,015,566
	Cumulative Non-Residential kWh converted (through goal year)	42,054,480
11	Average utility purchased cost/savings per kWh	-$0.013
	Non-Residential utility purchased cost/savings	**-$533,671**

11 The average cost/savings per kWh of utility purchased renewable energy subscription is based on utility fee information. Negative numbers indicate increased consumer spending

Non-Residential Savings - electrical energy efficiency

Formula:

Cumulative kWh saved from energy efficiency x Average cost per kWh = Gross Non-Residential electrical energy efficiency savings - Non-Residential Efficiency Upgrade Costs = Net Non-Residential Electrical Energy Efficiency Savings

	Commercial kWh saved (goal year)	16,821,792
	Cumulative commercial kWh saved (through goal year)	58,876,272
12b	Average cost per kWh	$0.096
	Gross Commercial electrical energy efficiency savings	**$5,656,047**
13	Commercial Electrical Efficiency Upgrade Costs	-$4,977,322
	Net Commercial Electrical Energy Efficiency Savings	**$678,726**

12b Energy efficiency savings per kWh saved based on average electricity cost per kWh reported for commercial and industrial with a weighted average (2/3rds commercial rate, 1/3rd industrial rate) reflecting typical non-residential electric consumption paterns: https://www.electricitylocal.com/

13 Assumed energy efficiency upgrade costs are calculated assuming an average ROI of12% (https://www.aceee.org/blog/2019/05/existing-homes-energy-efficiency) Negative numbers indicate increased consumer spending

Non-Residential Savings - natural gas energy efficiency

Formula:

Cumulative therms saved from energy efficiency x Average cost per therm = Gross Non-Residential natural gas energy efficiency savings - Non-Residential Natural Gas Efficiency Upgrade Costs = Net Non-Residential Electrical Natural Gas Efficiency Savings

14	Non-Residential therms saved (year 10)	665,651
14	Cumulative Non-Residential therms saved	2,329,778
15	Average cost per therm	$0.701
	Gross Non-Residential natrual gas energy efficiency savings	**$1,633,174**
14, 16	Non-Residential Natural Gas Efficiency Upgrade Costs	-$1,437,193
	Net Non-Residential Natural Gas Energy Efficiency Savings	**$195,981**

14 Includes fuel switching from fossil fuel heat to electric

15 Energy efficiency savings for natural gas is based on average natural gas cost per therm https://naturalgaslocal.com/

16 Assumed energy efficiency upgrade costs are calculated assuming an average ROI of12% (https://www.aceee.org/blog/2019/05/existing-homes-energy-efficiency) Negative numbers indicate increased consumer spending

Potential Total Cumulative Non-Residential Energy Cost Savings

Formula:

Non-Residential solar savings + Non-Residential community solar savings + Non-Residential utility purchased renewable + Non-Residential electrical efficiency savings + Non-Residential natural gas energy efficiency savings - Non-Residential increased electrical costs = Potential Total Cumulative Non-Residential Energy Savings

Non-Residential solar savings	$3,381,492
Non-Residential community solar savings	$0
Non-Residential utility purchased renewable cost/savings	-$533,671
Non-Residential electrical efficiency savings	$678,726
Non-Residential natural gas energy efficiency savings	$195,981
Potentail Total Cumulative Non-Residential Energy Savings	**$3,722,528**

Potential Total Cumulative Energy Cost Savings (Residential + Non-Residential)

Formula:

Energy sector savings - Energy sector cost increases = Potentail Total Cumulative Energy Cost Savigns

Energy Sector Savings		
Total solar energy savings		$4,860,852
Total community solar energy savings		$0
Total energy efficiency savings - electricity		$8,496,466
Total energy efficiency savings - natrual gas		$3,223,700
	Total Gross Energy Savings	$16,581,018
Energy Sector Cost Increases		
Total solar PV installation costs		(included in estimated Total Solar Energy Savings)
Total utility purchased renewable cost/savings		-$738,008
Total energy efficiency upgrade costs - electricity		-$7,476,890
Total energy efficiency upgrade costs - natrual gas		-$2,836,856
	Total Gross Energy Cost Increases	-$11,051,754
Potentail Total Cumulative Energy Cost Savings		**$5,529,264**

Summary of Estimated Cumulative Savings of Modeled Reductions
City of Fitchburg

Notes

Solid Waste - Residential

Residential savings - Food Waste Reduction

Formula:

Cumulative tons of food waste reduced and diverted x Average cost savings per ton	**= Residential food waste savings**
Residential food waste reduced (goal year)	374
Cumulative residential food waste reduced (through goal year)	1,309
17 Average cost savings per ton reduced	$2,469
Residential food waste savings	**$3,231,460**

17 Value per ton of residential food waste avoided is based on average for Prevent and Recover strategies by ReFED "A Roadmap To Reduce U.S. Food Waste" https://refed.com/downloads/the-roadmap-to-reduce-u-s--food-waste/ . Food waste share of total organics diverted is calculated based on available waste sort data (see Baseline Assessment document)

Potential Total Cumulative Residential Solid Waste Reduction Cost Savings

Residential food waste savings	**$3,231,460**

Notes

Solid Waste - Non-Residential

Non-Residential savings - Solid Waste Reduction

Formula:

Cumulative participant/years x Average reported cost savings per participant/year	**= Non-Residential solid waste savings**
Participating businesses (goal year)	8
Cumulative participant/years (through goal year)	48
18 Average cost savings per participant/year	$431
Commercial solid waste savings	**$72,408**

18 Savings per business engaged in waste reduction programs are based on MN WasteWise reported average business savings ($431) escallated to 5 year (mid point) Cumulative savings assume businesss reduction strategies remain in force. See https://www.mnchamber.com/your-opportunity/waste-wise

Commercial savings - Food Waste Reduction

Formula:

Cumulative tons of food waste reduced and diverted x Average cost savings per ton	**= Non-Residential food waste savings**
Commercial food waste reduced (goal year)	374
Cumulative non-residential food waste reduced (through goal year)	1,309
19 Average cost savings per ton reduced	$494
Commercial food waste savings	**$646,292**

19: Average cost savings per ton of food waste avoided is based on an assumed 20% wholesale share of value per ton of residential food waste average for Prevent and Recover strategies by ReFED "A Roadmap To Reduce U.S. Food Waste" https://refed.com/downloads/the-roadmap-to-reduce-u-s--food-waste/ Additionally, the World Resources Institute conducted a study which found that for every $1 invested in food waste reduction, businesses saved $14 in operational costs. See https://www.wri.org/news/release-new-research-finds-companies-saved-14-every-1-invested-reducing-food-waste

Potential Total Cumulative Solid Waste Savings

Formula:

Residential Food Waste Savings + Commercial Solid Waste Savings + Commercial Food Waste Savings = Potentail Total Cumulative Solid Waste Savings

Residential Food Waste Savings	$3,231,460
Non-Residential Solid Waste Savings	$72,408
Non-Residential Food Waste Savings	$646,292
Potentail Total Cumulative Solid Waste Savings	**$3,950,160**

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Appendix C
Abbreviations and Glossary of Terms

The following are abbreviations and terms used in the Sustainability Plan as well as others common to sustainability and climate action concepts.

Abbreviations

ADU	Accessory Dwelling Unit
BAU	Business as usual forecast
BEV	Battery electric vehicle
BIPOC	Black, Indigenous, People of Color
C&D	Construction and demolition
CAP	Climate Action Plan
CE	Carbon Equivalent
CDP	Carbon Disclosure Project
CFC	Chlorofluorocarbons
CH_4	Methane
CHP	Combined Heat and Power
CO_2	Carbon dioxide
CO_2 e	Carbon dioxide equivalent
CSG	Community Solar Garden
DCFC	Direct Current Fast Charger
DOE	U.S. Department of Energy
EMS	Emergency medical services
EPA	U.S. Environmental Protection Agency
EV	Electric vehicle
EVSE	Electric vehicle supply equipment
FEMA	Federal Emergency Management Agency
FTE	Full-time equivalent
GCoM	Global Covenant of Mayors
GDP	Gross Domestic Product
GHG	Greenhouse gas
GWP	Global warming potential
HFC	Hydrofluorocarbons
HVAC	Heating, Ventilation, and Air Conditioning
ICE	Internal Combustion Engine vehicle
IPCC	Intergovernmental Panel on Climate Change
kWh	Kilowatt-hour
LEED	Leadership in Energy and Environmental Design
LEV	Low emission vehicle
LIDAC	Lower Income and Disadvantaged Community
MWH	Megawatt hour – 1,000 Kilowatt-hours
MSW	Municipal Solid Waste
MT	Metric ton equivalent to 1,000 kg (also known as Metric Tonne)
MMT	Million Metric tons
MMBTU	Million British Thermal Units
MT CO_2 e	Metric tons of carbon dioxide equivalent
NGO	Non-Governmental Organization
N_2O	Nitrous Oxide
NO_x	Nitrogen Oxides
NOAA	National Oceanic and Atmospheric Administration
NZE	Net-Zero Emissions
O_3	Ozone
ODS	Ozone Depleting Substances
PACE	Property Assessed Clean Energy
PFC	Perfluorocarbons
PHEV	Plug-in hybrid electric vehicle
PM2.5	Particulate matter of 2.5 micrometer diameter or less
POC	People of Color
PPA	Power Purchase Agreement
PUB	Public Utilities Board
PV	Photovoltaic (solar photovoltaic)
REC	Renewable Energy Credit
RCP	Representative Concentration Pathway
SO_2	Sulfur Dioxide
SF_6	Sulfur Hexafluoride
SULEV	Super ultra-low emission vehicle
t	Ton equivalent to 2,000 lbs (United States)
TOG	Total Organic Gasses
USGS	U.S. Geological Survey
VMT	Vehicle miles traveled
VHT	Vehicle hours traveled
ZEV	Zero emission vehicle
ZNEB	Zero Net Energy Building

A

Accessory Dwelling Unit (ADU)
A secondary dwelling unit associated with a primary single-family home, which can be located within or attached to the main residence, or in a separate accessory building on the same property.

Action
Specific tasks set out to realize the objectives and methods highlighted in a given plan.

Activity Data
Information regarding the scale of human actions that lead to emissions or removals within a specified timeframe. This includes data like energy consumption, metal production, land coverage, management procedures, and usage of lime, fertilizers, and waste generation.

Adaptation
Refer to “Climate Readiness or Resilience”

Adaptive Capacity
The combination of societal, technological, and monetary abilities that individuals or groups possess to initiate and sustain actions against climate change.

Aerosols
Airborne particles, either solid or liquid, typically ranging between 0.01 and 10 micrometers. These particles, which can be of natural or human-made origin, can persist in the atmosphere for extended periods. They can affect climate by directly interfering with radiation or indirectly by influencing cloud properties.

Afforestation
The process of establishing forests on lands that weren't previously forested.

Air Pollutant
Any substance, either originating from human activities or naturally, present in the atmosphere that might have detrimental impacts on humans, fauna, flora, or materials.

Anthropogenic
In relation to greenhouse gas records, "anthropogenic" denotes emissions and removals directly stemming from human actions or from natural processes influenced by human activities.

Atmosphere
The layer of gases encasing the Earth. It mainly consists of nitrogen and oxygen, along with trace gases like argon, helium, and certain greenhouse gases like carbon dioxide and ozone. The atmosphere also encompasses varying amounts of water vapor and contains other components like clouds and aerosol particles.

B

Baseline Emissions
A reference point, either through measurement, calculation, or a specific timeframe, for making comparisons. It represents emission levels in scenarios devoid of policy changes or project implementations. Such evaluations are crucial to gauge the impact of emissions-reducing measures.

Base Year
The initial year used for data gathering. Emission-reducing goals are often set with this year as a reference.

Beneficial Electrification
Beneficial electrification is the process of replacing fossil fuels with electricity to reduce energy costs and greenhouse gas emissions. It can be applied to many sectors, including transportation, residential buildings, and commercial buildings.

Biogenic
Derived from the biological activities of living entities. The term "biogenic" exclusively pertains to recently formed biological materials. The IPCC suggests categorizing peat as fossil carbon due to its lengthy replacement cycle.

Biogeochemical Cycle
The continuous transfer of essential chemicals, crucial for life, within Earth's systems, including carbon, nitrogen, oxygen, and phosphorus.

Biomass
Refers either to (1) the combined weight of all living organisms within a designated area or species, usually represented as dry weight or (2) Organic substances originating from or recently derived from living beings, excluding peat, and encompasses derived products and waste.

Biomass Waste
Biological, non-fossil substances of biological origin that are either residual or discarded. This definition

includes biogenic municipal waste, landfill gas, and other forms of biomass but excludes certain fuels and biofuels. EIA's data on "biomass waste" also count energy crops produced specifically for power generation.

BIPOC
Defined as "Black, Indigenous, and People of Color", this U.S.-specific term emphasizes the experiences of Black and Indigenous communities, showcasing or influencing the broader socio-economic dynamics encountered by all non-white individuals.

Black Carbon
A type of aerosol characterized based on its capacity to absorb light, its chemical reactivity, and/or thermal resistance; comprises elements like soot and charcoal.

Blue Carbon
Carbon that's absorbed and retained by coastal ecosystems and wetlands, aiding in countering climate change impacts.

British Thermal Unit (BTU)
A conventional measure of thermal energy, representing the energy needed to elevate the temperature of a pound of water by a single degree Fahrenheit.

Business As Usual Forecast (BAU)
The Intergovernmental Panel on Climate Change (IPCC) describes this as the predicted emission levels if upcoming trends emulate historical ones and no additional policy amendments are enacted. This projection presumes no further emission-curbing actions will be adopted beyond existing or committed measures. BAU forecasts do include anticipated reductions resulting from existing requirements or commitments, such as federal vehicle fuel efficiency standards and electric utility carbon-reduction commitments, which are outside the scope of this plan.

C

Carbon Cycle
The systematic flow and storage of carbon across different reservoirs. This involves four primary carbon storage areas: the atmosphere, the terrestrial environment (including freshwater systems), oceans, and sediments (which encompass fossil fuels). The carbon exchanges between these reservoirs are driven by a mix of chemical, physical, geological, and biological factors. Though the ocean holds a significant amount of near-surface carbon, its exchange with the atmosphere is relatively slow.

Carbon Dioxide (CO_2)
A gas found naturally in the environment, but also produced from burning fossil fuels, biomass, through land-use alterations, and various industrial activities. As the main human-induced greenhouse gas, it impacts the Earth's ability to reflect heat. Other greenhouse gases are often measured relative to CO_2, which has a Global Warming Potential set at 1.

Carbon Dioxide Equivalent (CO_2 e)
A standard for comparing the emissions from different greenhouse gases based on their potential to warm the planet. It's determined by equating the amount of a gas emitted to the amount of CO_2 that would have the same global warming impact.

Carbon Disclosure Project (CDP)
A global initiative allowing organizations and cities to publicly share their environmental impacts, notably related to climate risks. CDP stands as one of the recognized disclosure platforms endorsed by GCoM.

Carbon Emissions
The process of releasing carbon dioxide into the atmosphere, primarily through human activities like burning fossil fuels for energy.

Carbon Equivalent (CE)
A metric for comparing emissions from various greenhouse gases based on their capacity to influence global warming. Carbon equivalents are derived from carbon dioxide equivalents using a specific conversion factor related to molecular weights.

Carbon Free
Activities, systems, or products that don't emit carbon dioxide or other greenhouse gases. Often associated with sustainable or renewable energy discussions, not every "carbon free" source is renewable. For instance, while both wind and nuclear energy are carbon-free, only wind is renewable.

Carbon Intensity

The ratio of carbon emitted for every unit of energy used. A typical measure of this is the carbon weight per British thermal unit (Btu) of energy. When considering a single fuel type, carbon intensity and the emission coefficient are the same. With multiple fuels, it's an aggregate value.

Carbon Neutral / Carbon Neutrality
Achieving a balance where the amount of CO_2 produced annually is equal to the amount removed or offset, leading to net-zero CO_2 emissions by a specific date. Carbon Neutrality is also sometimes applied to all greenhouse gas emissions. In those instances the term is sometimes used interchangeably with “Net Zero” or “Climate Neutral”

Carbon Offsets
Mechanisms to counterbalance carbon dioxide or other greenhouse gas emissions by funding equivalent reductions elsewhere. They are quantified in metric tonnes of CO_2 -equivalent and can be traded to neutralize emissions from an entity's operations.

Carbon Sinks
Natural environments, such as forests or oceans, recognized for their ability to absorb and store carbon dioxide from the atmosphere.

Carbon Sequestration
The process of capturing and storing CO_2, either in oceans, terrestrial environments like forests and soils, or in geological formations underground.

Chlorofluorocarbons (CFCs)
Gases, regulated under the 1987 Montreal Protocol, used in several applications like refrigeration and air conditioning. Since they don't break down in the lower atmosphere, they reach the upper atmosphere and can deplete ozone. Their usage is being phased out in favor of alternative compounds, some of which are greenhouse gases under the Kyoto Protocol.

Circular Economy
A sustainable economic model that deviates from the traditional linear approach (produce, use, discard) by focusing on reducing resource inputs and waste. It emphasizes durable product design, repair, reuse, and recycling to minimize waste.

Climate
Often described as the "typical weather" of an area, climate is a statistical representation of weather patterns over extended periods, typically 30 years as per World Meteorological Organization (WMO) standards. It encompasses averages and variability of factors like temperature and precipitation. On a broader scale, climate is the comprehensive state of the climate system, including statistics.

Climate Adaptation or Resilience
The ability of ecosystems or communities to anticipate, stand against, respond, and recover from disruptive events. It involves adjusting to changing climate conditions to lessen risks and vulnerabilities.

Climate Action Plan
A comprehensive strategy detailing steps that a municipality, business, or government will take to decrease greenhouse gas emissions and prepare for climate change, fostering sustainable and resilient growth.

Climate Change
Any significant, lasting change in the average or variability of climate conditions over extensive periods. It can stem from natural processes, persistent changes in atmospheric composition due to human activities, or alterations in land use.

Climate Hazard
A climate event or situation that can negatively affect human health, resources, or livelihoods, encompassing sudden shifts in climate systems like heavy rainfall or prolonged droughts.

Climate Migration
The relocation of individuals due to the effects of climate change impacting their way of life or degrading their living conditions. This can result from changing water supplies, altered agricultural yields, or factors like rising sea levels and increased storm intensity.

Climate Model
A mathematical representation used to simulate the key components of climate, including the atmosphere, oceans, land, and ice. These models are used to forecast potential future climate changes.

Climate Neutral / Climate Neutrality

Achieving a balance where the amount of all GHG emissions produced annually is equal to the amount removed or offset, leading to net-zero GHG emissions by a specific date. "Climate Neutral" is sometimes used interchangeably with "Carbon Neutral", however, "Carbon Neutral" often interpreted as addressing CO_2 emissions only, whereas "Climate Neutral" is intended to address all GHG gases.

Climate Scenario
A structured and logical narrative of potential future climatic conditions, built on a set of assumptions about potential future events.

Climate Risk
The potential negative outcomes due to climatic changes, where valuable assets are at risk. The risk is calculated based on the likelihood of certain climate events or changes happening and the potential impact of those changes. It is a product of the system's vulnerability and the climate hazards faced.

Climate Vulnerability
The extent to which a system is at risk from adverse climate changes, including climate variability and extremes. It depends on how exposed the system is to these changes, its inherent sensitivity, and its ability to adapt. Vulnerability can be described as the potential negative impact minus the system's adaptive capacity.

Climate Vulnerability Assessment
An analysis aiming to pinpoint and categorize the threats posed by climate change. It guides the creation of strategies to address these threats and can cover diverse areas like food security, socio-economic factors, and extreme weather patterns.

Co-Benefit
Additional advantages or benefits (e.g., health, economic, societal) that arise indirectly from climate adaptation and mitigation measures.

Co-generation
A facility or system that simultaneously and efficiently produces multiple forms of energy, usually heat and power, in an integrated manner.

Community Choice Aggregation (CCA)
CCA programs, or sometimes known as "Community Power Aggregation", empower local governments to source power for their citizens, businesses, and municipal facilities from alternative providers, while still utilizing the distribution services of their existing utilities. Setting up a CCA generally needs state-level legislation. For more details, one can visit EPA's dedicated CCA website: [EPA's CCA webpage](https://www.epa.gov/green-power-markets/community-choice-aggregation)

Combined Heat and Power (CHP)
A system designed to concurrently generate electricity and useful heat, aiming for optimal energy use. Some utilities might sell the heat produced for public use, while certain industries might sell surplus electricity to other businesses or utility companies.

Community Power Aggregation
Refer to "Community Choice Aggregation"

Community Solar / Community Solar Garden (CSG)
Shared solar installations that allow community members to benefit from solar energy without installing panels on individual properties. Participants receive bill credits based on their share of the generated power. Generally, the electricity from community solar farms is priced lower than traditional utility rates.

Complete Streets
A street design concept that ensures streets are made to accommodate all users safely and efficiently, regardless of their mode of transportation or age.

Consistency
Ensuring that an inventory remains uniform in its methodologies and data over time. If the same methods and datasets are consistently applied over years, then the inventory is considered consistent.

Continuous Emission Monitor (CEM)
A monitoring system placed within smokestacks or other emission sources that continuously measures and reports air emissions.

Cool Roof
Roofing materials engineered to reflect more sunlight and absorb less heat, thereby reducing the heat transferred to the building or its surroundings.

Cool Pavement

Pavement materials designed to reflect sunlight and decrease heat absorption, minimizing heat transfer to the nearby environment.

Criteria Air Pollutant
Specific air pollutants for which permissible exposure levels are determined, and corresponding air quality standards are established. Examples include carbon monoxide, ozone, and various particulates. The term arises from the U.S. EPA's obligation to define these pollutants and their impacts on health and the environment. Standards can be reviewed and updated based on new scientific information.

D
Decarbonization
The transition towards reducing carbon emissions by adopting cleaner energy sources, enhancing energy efficiency, or capturing and storing released carbon. The ultimate aim is to minimize the climate impact and move towards a carbon-neutral society.

Deforestation
The conversion of forested areas into non-forest uses. Deforestation is often linked to the amplified greenhouse effect for two main reasons: the combustion or decay of wood releases carbon dioxide, and the removed trees no longer absorb atmospheric carbon dioxide through photosynthesis.

Demand Side Management (DSM)
Initiatives designed to modify consumer energy consumption patterns using methods like education and financial incentives. DSM seeks to reduce energy consumption, particularly during peak demand periods, and shift usage to times when demand is typically lower.

Direct Current Fast Charger (DCFC)
DCFC charging is designed to deliver more power at faster speeds than Level 2 chargers with outputs ranging from 50 kW to 350 kW. They can recharge an EV battery to 80% in anywhere from 15 minutes to 45 minutes, depending on the vehicle's voltage capacity. DCFC is also sometimes known as “Level 3 charging”, or “Rapid Charging”.

Distillate Fuel Oil
A category of petroleum products obtained through standard distillation processes. This encompasses diesel fuels and fuel oils, including types like No. 1, No. 2, and No. 4 diesel fuel. These products are used in various engines, from road vehicles to trains and agricultural equipment. Additionally, No. 1, No. 2, and No. 4 fuel oils are typically employed for heating spaces and generating electricity.

District Heating
A system that distributes heat, generated at a centralized point, via a network of pipes to provide heating for homes and businesses in a specified area or community.

E
Ecosystem Services
The benefits ecosystems offer to human welfare. These benefits range from tangible resources like water and food to services like air purification, flood control, and climate stabilization.

Electric Vehicle (EV)
A vehicle that can be powered by an electric motor that draws electricity from a battery and is capable of being charged from an external source. An EV includes both a vehicle that can only be powered by an electric motor that draws electricity from a battery (all-electric vehicle) and a vehicle that can be powered by an electric motor that draws electricity from a battery and by an internal combustion engine (plug-in hybrid electric vehicle).

Electric vehicle supply equipment (EVSE)
The infrastructure that allows electric vehicles to charge from an electricity source. It's also known as an EV charging station, EV charger, or charging dock. EVSE takes electrical power from the grid and transfers it to the vehicle's battery.

Emissions
The act of discharging certain substances, often gases in the context of climate change, into the environment.

Emission Factor
A value that signifies the amount of a gas emitted or removed per unit of activity. This coefficient is usually derived from a collection of measurement data and provides a representative emission rate for a set of specific conditions.

Emission Inventory
A calculation of the total pollutants released into the atmosphere from various significant sources, measured over a defined period, such as daily or annually.

Emission Rate
The quantity of a specific pollutant released over a set duration, commonly expressed in units like tons per year.

Energy Burden
The fraction of a household's total income spent on energy costs. An "high" energy burden is identified when energy costs comprise 6% or more of the household income, while it's deemed "severe" if above 10%.

Energy Savings / Energy Efficiency
Refers to the sustainable reduction in the amount of energy consumed for the same level of output or performance. For instance, a modern heater that requires less energy to provide the same warmth results in energy efficiency improvements.

Energy Tariff
A pricing structure, or utility tariff, that dictates how consumers are charged by energy providers for their electric or gas consumption. Energy tariffs are subject to government approval and review.

Environmental Justice
The equitable treatment and active participation of all individuals, regardless of their race, ethnicity, income, or origin, in the processes related to environmental laws, policies, and regulations.

Equity
Being just and fair in treatment, acknowledging that people have diverse circumstances and providing them with the necessary resources and opportunities to achieve equal outcomes. In terms of climate change, equity encompasses both shielding from environmental hazards and ensuring access to environmental benefits, irrespective of socio-economic factors.

F

Federal Emergency Management Agency (FEMA)
A federal agency that leads the country's response to disasters, including natural disasters, man-made incidents, and terrorist events.

Fluorocarbons
Molecules made up of carbon and fluorine, which can also include elements like hydrogen, chlorine, or bromine. Some well-known types are chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs).

Flux
(1) Materials, like limestone and dolomite, used to moderate the heat or energy demands of mineral processing, like metal smelting. They can also function as agents to produce slag. (2) The rate or volume of a liquid or gas moving across a specific area over time, such as the " CO_2 absorption rate by forests".

Fossil Fuel
Deposits of hydrocarbons formed from ancient organic matter, including coal, oil, and natural gas.

Fuel Combustion
The intentional burning of materials in a device designed to provide heat or mechanical energy. This process can be for direct application or use elsewhere.

Fuel Switch (see also “Beneficial Electrification”)
The process of transitioning from one energy source to another, commonly from non-renewable sources like fossil fuels to renewable ones like wind or solar, to reduce both costs and emissions.

Fugitive Emissions
Unintentional leaks of gases from surfaces such as seals or underground pipelines due to deterioration or faults.

G

Geologic Carbon Sequestration
The practice of capturing CO_2, often from sources like coal-powered plants, and injecting it deep underground for storage. With careful site selection and management, this approach has potential in reducing atmospheric CO_2 levels.

GHG
Refer to “Greenhouse Gas”

Global Environmental Change
Significant, accelerated alterations to Earth's natural systems, encompassing climate shifts, biodiversity loss, resource depletion, pollution, and other large-scale environmental disruptions.

Global Warming

The average rise in atmospheric temperature near the Earth's surface and within the troposphere, which can lead to shifts in global climate. This warming can arise from both natural phenomena and human activities. Typically, "global warming" is used to refer to the temperature increase resulting from the enhanced emissions of greenhouse gases due to human actions. See also Climate Change.

Global Warming Potential (GWP)
An index that calculates the radiative effects of greenhouse gases, considering their ability to trap heat compared to carbon dioxide over a specified timeframe. The GWP evaluates the cumulative effect of these gases in the atmosphere based on their longevity and their potential to absorb infrared radiation. The Kyoto Protocol uses GWPs derived from 100-year timespan emissions.

GCoM Global Covenant of Mayors
GCoM represents the world's largest alliance dedicated to urban climate leadership. Comprising over 10,000 city and local governments, GCoM's goal is to encourage and support action on climate and energy at the grassroots level globally.

Green Streets
An urban design approach that incorporates plant life, soil, and engineered structures to manage, slow, and purify stormwater runoff from surfaces that don't absorb water.

Greenhouse Effect
A natural process where specific gases in the atmosphere trap heat near the Earth's surface, leading to a warming effect. If concentrations of these greenhouse gases increase, this effect intensifies, leading to a gradual increase in the Earth's temperature.

Global Protocol for Community-Scale Greenhouse Gas Emissions Inventories
A comprehensive and transparent framework adopted globally for cities and local governments to consistently measure, calculate, and report their greenhouse gas emissions.

Greenhouse Gas
A gas that can absorb and emit infrared radiation, contributing to the greenhouse effect. Some common greenhouse gases include water vapor, carbon dioxide, methane, nitrous oxide, and certain industrial gases like hydrofluorocarbons.

Greenhouse Gas Reduction
Efforts aimed at diminishing the amount of greenhouse gases released into the atmosphere, thereby mitigating potential adverse climate impacts.

Green Infrastructure
Green infrastructure encompasses a diverse array of green spaces and features, both in urban and rural areas, that serve to enhance the well-being of communities and provide environmental advantages. It extends beyond traditional open spaces like parks and playing fields to include a range of measures that use plant or soil systems, permeable pavement and surfaces, stormwater harvest and reuse, or landscaping to manage stormwater and reduce flows to sewer systems or to surface waters. This approach helps counter water pollution in urbanized areas caused by stormwater carrying contaminants

Green Roof
A roof that incorporates vegetation over a waterproof layer. Green roofs can be categorized as extensive, intensive, or semi-intensive based on the depth of planting medium and amount of maintenance they require. They offer benefits like mitigating the heat island effect, managing stormwater, and enhancing green space in urban areas.

Green Wall
This is a vertical extension of the green roof concept, where vegetation is grown on building exteriors.

Gross Domestic Product (GDP)
The total value of goods and services produced within a country's borders in a specific timeframe, typically a year. It doesn't account for the depreciation of assets or depletion of natural resources.

Groundwater
Water located beneath the Earth's surface, filling the spaces between soils and rocks.

H

Halocarbons
A group of organic compounds composed partially of halogens. They encompass chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs), halons, and more. Many

halocarbons have significant Global Warming Potentials and some also contribute to ozone layer depletion.

Hazard
The potential for an event, whether natural or human-induced, to cause harm to people, property, infrastructure, or the environment.

Heat Island
An urban area that exhibits higher temperatures than its surrounding rural areas due to human activities. This phenomenon is attributed to factors like heat-absorbing surfaces and structures. See also "Micro Heat Island".

Heating, Ventilation, and Air Conditioning (HVAC)
a term that refers to systems that regulate and move heated and cooled air throughout buildings. HVAC systems are used to improve air quality and maintain a comfortable indoor climate.

Hydrocarbons
Compounds made up of only hydrogen and carbon atoms. The term can also refer to petroleum compounds which might contain elements like sulfur, nitrogen, or oxygen. Unsaturated hydrocarbons contain either double or triple carbon-carbon bonds.

Hydrofluorocarbons (HFCs)
Molecules made up of hydrogen, fluorine, and carbon. These were developed as replacements for ozone-depleting substances and are used in a variety of industrial processes. While HFCs don't deplete the ozone layer, they are potent greenhouse gases with varying Global Warming Potentials.

I
ICLEI Local Governments for Sustainability:
An association of local governmental entities focused on reducing carbon emissions and fostering sustainable urban growth. ICLEI members, along with a team of specialists, collaborate through capacity building, partnerships, and peer interaction to effect change towards urban sustainability.

Impact
A consequence or effect that arises due to climate change on any system's structure or functioning. Examples include severe heatwaves, sea-level rise, or alterations in rainfall causing floods or droughts.

Indicator
A numerical representation highlighting a specific facet of vulnerability to climate change. For instance, a forecasted alteration in annual average temperature or the count of species at risk.

Internal Combustion Engine Vehicle (ICE)
Vehicles which ignite and combust fuel within an internal combustion engine. Fuels used in ICE vehicles are typically gasoline and diesel.

Intergovernmental Panel on Climate Change (IPCC)
Founded in 1988 by the World Meteorological Organization and the United Nations Environment Programme, the IPCC is tasked with evaluating scientific and technical information related to all aspects of climate change. The IPCC informs governments about the state of knowledge of climate change by examining all the relevant scientific literature on the subject. The IPCC is scientific entity and is not a legislative body.

K
Kilowatt Hour (kWh):
A unit representing electrical energy consumption, equivalent to using 1,000 watts continuously for an hour.

Kyoto Protocol
A supplement to the United Nations Framework Convention on Climate Change (UNFCCC) ratified in Kyoto, Japan, in 1997. This protocol incorporates legally binding obligations to reduce greenhouse gas emissions. Countries listed in the Protocol's Annex B pledged to reduce their emissions of six major greenhouse gases by at least 5% from 1990 levels between 2008 and 2012. The Protocol became effective on February 16, 2005.

L
Land Use and Land Use Change
Land use pertains to the human activities performed on a certain type of land cover. Meanwhile, land use change denotes alterations in how land is managed or utilized by humans, which can influence land cover. Changes in land cover and land use can affect climate properties such as surface albedo and greenhouse gas sources/sinks, potentially influencing climate on various scales.

Leadership in Energy and Environmental Design (LEED)

LEED is a certification system for evaluating and promoting sustainable building and design practices. Developed by the U.S. Green Building Council (USGBC), LEED provides a framework for environmentally responsible construction, aiming to improve energy efficiency, reduce water usage, and decrease greenhouse gas emissions. Buildings can earn LEED certification at different levels (Certified, Silver, Gold, or Platinum) based on their performance across several criteria, including energy use, indoor environmental quality, and sustainable site development.

Level 1 Charger
An electric vehicle charging device that provides charging through a common residential 120-volt (120V) AC outlet. Level 1 chargers can take 40-50+ hours to charge a BEV to 80 percent from empty and 5-6 hours for a PHEV.

Level 2 Charger
An electric vehicle charging device with a higher AC charging capacity than Level 1 chargers. They typically operate at 240V for residential use or 208V for commercial use. Level 2 chargers can charge a BEV to 80 percent from empty in 4-10 hours and a PHEV in 1-2 hours.

LIDAC Communities
Low Income / Disadvantaged Communities (LIDACs): communities where residents have low incomes, limited access to resources, and face disproportionate environmental or climate burdens.

Living Streets
"Living streets" amalgamate the principles of green streets and complete streets while emphasizing the enhancement of residents' life quality in urban areas.

LULUCF
An abbreviation for "Land Use, Land Use Change, and Forestry," a category in greenhouse gas inventory documentation.

M
Megawatt Hour (MWH):
An electrical energy unit denoting the consumption of a million watts over an hour.

Methane (CH_4)
A hydrocarbon that acts as a greenhouse gas with a global warming potential estimated to be 28 times stronger than carbon dioxide. Methane arises from several sources, including decomposition in landfills, flooded rice fields, digestion in animals, and fossil fuel production. The GWP value is sourced from the IPCC's Fifth Assessment Report (AR5).

Metric Ton
Equivalent to a Megagram or 1,000 kilograms, a metric ton, sometimes referred to as a metric tonne, is a standard international unit for mass.

Micro Heat Island
Smaller localized zones within urban environments experiencing elevated temperatures in comparison to surrounding areas. Such hotspots might include asphalt roads, non-green roofs, or barren parking lots. The microclimate and unique built environment conditions heavily influence these micro heat islands. Refer also to "Heat Island".

Million Metric Tons (MMT)
A standard measurement often utilized in greenhouse gas documentations, equivalent to a Teragram (Tg).

Mitigation:
Efforts to reduce or curb the extent or speed of long-term climatic warming and its associated effects. Mitigation typically encompasses the reduction of human-induced greenhouse gas emissions.

Mobile Sources
Transportation means that emit pollutants, including cars, motorbikes, trucks, off-road vehicles, boats, and planes.

Mode Share
The proportion of travelers opting for a specific mode of transportation. Mode share serves as a vital metric when shaping sustainable transportation strategies in a city or region, as it highlights the prevalent use of different transport options. This metric showcases the effectiveness of infrastructures, policies, investments, and urban designs in facilitating various transport modes.

Model
A model serves as a numerically-based representation of real-world scenarios, often omitting or simplifying certain details to emphasize core elements.

Municipal Power Aggregation
Refer to “Community Choice Aggregation.”

Municipal Solid Waste (MSW)
Waste originating from homes and certain non-hazardous industrial, institutional, and commercial sources. Typically, this waste is directed to municipal disposal sites.

N

National Oceanic and Atmospheric Administration (NOAA)
A US agency responsible for weather forecasting, monitoring oceanic and atmospheric conditions, charting the seas, conducting deep-sea exploration, and managing fishing and protection of marine mammals and endangered species in the US exclusive economic zone.

Natural Sources
Emission sources that aren't human-induced, including biological, geological sources, wildfires, and dust carried by the wind.

Net Energy Metering (NEM)
Net Energy Metering, commonly referred to as Net Metering, enables residential and business consumers generating their own solar energy to sell their surplus electricity back to the grid. The rate schedule for NEM determines compensation for this electricity. While net metering laws exist in many states, in others, utilities may offer these programs either voluntarily or due to regulatory decisions.

Net Zero Emissions (NZE)
Pertains to a community, business, institution, or building that balances its greenhouse gas emissions by producing or compensating with carbon-neutral energy, resulting in a zero net emission over a year.

Nitrogen Fixation
The process where atmospheric nitrogen gas transforms into forms beneficial for plants and other organisms, achieved through lightning, bacteria, and blue-green algae. This process is integral to the nitrogen cycle.

Nitrogen Oxides (NOx)
Gaseous compounds comprising nitrogen and oxygen. These gases emerge from vehicle exhaust and power generation. As they can form photochemical ozone, impact visibility, and harm health, they're deemed pollutants.

Nitrous Oxide (N_2O)
A potent greenhouse gas with a warming potential 265 times greater than carbon dioxide. Key sources encompass soil management practices, fossil fuel burning, and biomass combustion. Its global warming potential is derived from the IPCC's Fifth Assessment Report (AR5).

Non-Governmental Organization (NGO)
a group that works independently of governments to improve social conditions. NGOs are often non-profit institutions that are established at the community, national, or international level.

O

Ozone (O_3)
A gaseous compound composed of three oxygen atoms. In the troposphere, ozone forms naturally and through photochemical reactions involving human-produced gases. In the stratosphere, it forms when solar UV radiation interacts with diatomic oxygen. While tropospheric ozone is a greenhouse gas, stratospheric ozone is vital for blocking harmful UV radiation.

Ozone Depleting Substances (ODS)
Compounds causing the depletion of the stratospheric ozone layer. This category includes substances like CFCs, HCFCs, halons, and more. These substances, predominantly stable in the troposphere, degrade in the stratosphere under UV radiation, releasing ozone-depleting chlorine or bromine.

P

Perfluorocarbons (PFCs)
Man-made compounds solely composed of carbon and fluorine. Used as substitutes to ozone-depleting substances and emitted during certain industrial processes. Despite not depleting the ozone, they are formidable greenhouse gases. (IPCC's Fourth Assessment Report (AR4))

Phantom Load
Refers to the power consumed by electronic devices and appliances even when switched off. Devices drawing "phantom loads" constantly utilize electricity.

Photosynthesis
A biological process where plants absorb carbon dioxide to produce carbohydrates, releasing oxygen

in the process. The mechanism varies based on different atmospheric carbon dioxide concentrations.

Plug-in hybrid electric vehicle (PHEV)
A type of vehicle that combines features of both gasoline-powered and electric vehicles. PHEVs use batteries to power an electric motor, and another fuel, such as gasoline or diesel, to power an internal combustion engine or other propulsion source. PHEVs can charge their batteries through charging equipment and regenerative braking

Plug Load
Refers to the energy consumption of devices plugged into electrical outlets. In offices, major plug loads include computers, printers, and copiers. As buildings become more energy efficient, the relative importance of plug loads increases.

POC
An acronym for “People of Color” or “Person of Color”, encompassing all non-white demographic groups. See also “BIPOC”

Point Sources
Specific locations emitting pollutants into the atmosphere, like industrial smokestacks.

Power Purchase Agreement (PPA)
A contract where one party, the generator, produces electricity, and the other, the buyer, agrees to purchase it. Individual or grouped customers can forge PPAs with energy developers. PPAs enable long-term renewable energy commitments and can serve as direct renewable energy investments.

Property-Assessed Clean Energy (PACE)
A financial structure allowing property owners to fund renewable energy and energy efficiency improvements. Eligible properties include residential, commercial, and industrial sites. Upgrades can be geared toward energy efficiency, renewable energy, and water conservation.

Process Emissions
These are emissions resulting from chemical transformations in industrial processes that are distinct from burning

R
RCP 8.5
A Representative Concentration Pathway climate model frequently considered the climate model representing “business as usual” forecasts if global GHG emissions are not reduced and fossil fuels are continued to be used.

Radiative Forcing
A shift in equilibrium between incoming sunlight and outgoing infrared radiation. Ordinarily, the Earth's incoming and outgoing radiations are almost balanced. However, the introduction of greenhouse gases captures more infrared radiation, reflecting it back to Earth's surface, leading to a warming effect.

Reforestation
The act of reintroducing forests on lands that once held forests but were later repurposed.

Regeneration
The process of reestablishing young trees, either naturally or through human intervention, typically preserving the existing forest type after the previous forest has been removed.

Renewable Energy
Energy sourced from naturally renewable elements such as the sun, wind, water, and geothermal heat.

Renewable Energy Credits (RECs)
Certificates representing the benefits and attributes of electricity generated from renewable sources. Each REC represents one megawatt-hour (MWh) of renewable electricity dispatched to the grid. The largest reduction in Evanston's emissions is attributed to REC purchases.

Representative Concentration Pathway (RCP)
climate change scenarios to project future greenhouse gas concentrations. These pathways describe future greenhouse gas concentrations and have been formally adopted by the IPCC. There are a range of RCP climate models from RCP 2.6 to RCP 8.5 reflecting a range of potential human-made GHG emission scenarios. The numbers represent the expected change in radiative forcing through the end of the 21st century.

Residence Time
The typical duration a single atom or molecule remains in a particular storage area. In the context of greenhouse gases, it generally refers to the duration a molecule lingers in the atmosphere.

Resilience / Resiliency
The capacity to foresee, ready for, counteract, and promptly bounce back from climate-induced threats, ensuring minimal damage to society, economy, and natural settings.

Resilience Hub
A resilience hub is a community-serving facility that supports residents and communities before, during, and after emergencies. Resilience hubs can also provide resources to support communities in reducing greenhouse gas emissions.

Reservoir
Either (1) a part of the climate system where a greenhouse gas or its precursor is housed; or (2) human-manipulated water bodies where significant variations in water area might occur due to water regulation.

Respiration
A biological process where living entities transform organic substances into carbon dioxide, using up oxygen and releasing energy in the process.

Retro-commissioning
A comprehensive approach to enhance a building's operational efficiency by ensuring its control systems operate optimally and align with the building's intended and actual usage.

Ride-share
A system where individuals share transport means, usually through carpooling or joining a vanpool. Typically facilitated by a platform connecting drivers with potential riders.

S
Scope 1:
Refers to emissions discharged directly within the city's boundaries due to fossil fuel combustion and the decomposition of waste in landfills and wastewater facilities.

Scope 2:
Refers to emissions generated outside the city resulting from the city's consumption of electricity.

Scope 3:
Pertains to emissions linked to local government functions that can be quantified and disclosed but don't fall under Scope 1 or 2. Examples include outsourced activities and commuting of employees.

Short Ton
A standard ton measurement in the U.S., equivalent to 2,000 lbs or about 0.907 metric tons.

Sink
Any activity, process, or mechanism responsible for removing a greenhouse gas, aerosol, or their precursor from the atmosphere.

Social Cost of Carbon
An estimation of the economic damage due to climate change effects, calculated as the monetary value of total damages arising from emitting a single ton of carbon dioxide.

Solar Radiation
The sun's emitted electromagnetic waves. This radiation, also known as shortwave radiation, has wavelengths mainly in the visible spectrum due to the Sun's temperature.

Solar Photovoltaic (PV)
A system that directly transforms sunlight into electricity using semiconductors, primarily silicon. Suitable for homes, businesses, and large-scale operations, solar PV systems can be roof-mounted, ground-based, or integrated into building structures to produce renewable energy.

Source
Any process or activity that introduces greenhouse gases, aerosols, or their precursors into the atmosphere.

Stationary Sources
Fixed locations like power stations, manufacturing plants, and refineries that emit pollutants into the air.

Strategy / Strategic Goal
Detailed directions built upon the foundation of the sustainability vision and GHG reduction objectives that guide future policy decisions, community investments, and initiatives.

Sulfur Dioxide (SO_2)
A molecule made of one sulfur atom and two oxygen atoms. Released both naturally and by human activity, it can transform into sulfate aerosols in the

atmosphere. These aerosols can cool the Earth's surface, contribute to acid rain, and decrease visibility.

Sulfur Hexafluoride (SF_6)
A colorless gas that mixes well with alcohol and ether but less so with water. It's an extremely potent greenhouse gas, with a global warming potential much higher than carbon dioxide (CO_2). SF6 is predominantly used in electricity transmission and as an insulator in electronics. Its global warming potential is derived from the IPCC's Fourth Assessment Report (AR4). It is a potent greenhouse gas with a warming potential 23,500 times greater than carbon dioxide.

T

Terrestrial Carbon Sequestration
The process where trees, plants, and crops absorb carbon dioxide (CO_2) from the atmosphere through photosynthesis and store it as carbon in biomass (like tree stems, branches, and roots) and soil. This stored carbon creates "sinks" which counteract emissions when the absorbed carbon is greater than the released carbon over time.

Therm
A unit of energy equivalent to 100,000 British Thermal Units, roughly akin to the energy in 100 cubic feet of natural gas. Commonly used to gauge natural gas consumption for billing.

Total Organic Gases (TOG)
Organic gases that encompass both reactive and relatively non-reactive compounds, such as methane.

Transparency
Clear presentation of methodologies and assumptions used in an inventory so users can easily replicate and evaluate the inventory. Transparency is crucial for effective communication and consideration of information.

Trend
A measure of a quantity's change over time. A positive trend signifies growth, while a negative one indicates a decline. It's expressed in percentage or fractional terms concerning the quantity's initial value.

U

Urban Tree Canopy
The composition and traits of trees in urban settings.

U.S. Department of Energy (DOE)
A federal agency that oversees the nation's nuclear infrastructure, energy policy, and funds scientific research in the field.

U.S. Environmental Protection Agency (EPA)
A federal agency tasked with safeguarding human health and the environment. It offers technical support for recovery planning, long-term cleanup, and environmental surveillance. This includes assistance with public health infrastructure, such as wastewater treatment plants, and addressing threats through monitoring, assessment, and decontamination efforts

V

Vehicle Miles Traveled (VMT):
Represents the distance traveled by vehicles, be it cars, trucks, or motorcycles. Each mile is counted as one vehicle mile, irrespective of the number of passengers.

Vision Zero:
A strategy focused on eliminating severe injuries and fatalities from traffic accidents, aiming to provide safe and equal mobility for all individuals.

Vulnerability
The extent to which a system is exposed to, sensitive to, or unable to handle the adverse impacts of climate change. This encompasses:

- Exposure: The presence of assets or organisms in areas potentially adversely impacted by climate change.
- Sensitivity: The level at which assets or organisms are impacted by climate change.
- Adaptive capacity: The capability of systems, assets, or organisms to adjust to detrimental impacts.

W

Water Vapor
The predominant greenhouse gas present in the form of water in its gaseous state in the atmosphere. Water vapor is a natural part of the greenhouse effect. Its concentration is not significantly altered by human activities, but it amplifies the greenhouse effect due to positive feedback mechanisms. Water vapor also plays a vital role in climate regulation by forming clouds and precipitation.

Weather
Weather represents the immediate atmospheric conditions at a specific time and place, while climate refers to the long-term average of these conditions in a particular region over an extended period. In simpler terms, weather is what you experience outdoors on any given day, while climate describes the typical weather patterns you'd anticipate for a particular season and location.

Z

Zero Emission Vehicles (ZEV)
A vehicle that doesn't release harmful pollutants during its operation. Examples include electric cars, hydrogen-fueled vehicles, and bicycles. These emissions, when released, can have detrimental effects on both the environment and human health.

Zero Net Energy Building (ZNEB)
Also known as a Net-Zero Energy Building is one that is optimally efficient, and over the course of a year, generates renewable energy onsite equal to or greater than the total amount of energy consumed onsite.

Zero Waste
An approach focusing on the efficient utilization of resources through responsible production, consumption, and recovery. This means products, packaging, and materials are reused and recycled without causing harm to the environment or health, and without resorting to incineration or releases to land, water, or air.

Appendix D
References

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The following are sources and additional references used in the Sustainability Plan.

City of Fitchburg Sustainability Plan References

Introduction

1 Estimating the Health-Related Costs of 10 Climate-Sensitive US Events During 2012: https://www.nrdc.org/resources/bitter-pill-high-health-costs-climate-change

2 Stop Climate Change, Save Lives: https://www.nrdc.org/stop-climate-change-save-lives

3 World Health Organization Building Capacity on Climate Change for Human Health Toolkit: https://www.who.int/activities/building-capacity-on-climate-change-human-health/toolkit/cobenefits

4 United Nations Economic Commission for Europe: https://unece.org/DAM/Sustainable_Development_No._2__Final__Draft_OK_2.pdf

5 US EPA, Benefits of Global Action; https://www.epa.gov/sites/default/files/2015-06/documents/cirareport.pdf

6 Bollen, J. et al. (2009), Co-benefits of Climate Change
Mitigation Policies: Literature Review and New Results, https://www.oecd-ilibrary.org/economics/co-benefits-of-climate-change-mitigation-policies_224388684356

7 US EPA, Report on the Social Cost of Greenhouse Gases; Estimates Incorporating Recent Scientific Advances, November 2023; https://www.epa.gov/system/files/documents/2023-12/epa_scghg_2023_report_final.pdf

8 West JJ, Smith SJ, Silva RA, Naik V, Zhang Y, Adelman Z, Fry MM, Anenberg S, Horowitz LW, Lamarque JF. Co-benefits of Global Greenhouse Gas Mitigation for Future Air Quality and Human Health. https://doi.org/10.1038%2FNCLIMATE2009

9 Mapping the co-benefits of climate change action to issues of public concern in the UK: a narrative review: https://www.thelancet.com/journals/lanplh/article/PIIS2542-5196(20)30167-4/fulltext

10 Union of Concerned Scientists, Top 10 Benefits of Climate Action: https://www.ucsusa.org/resources/top-10-benefits-climate-action

11 Based on existing average economic value per acre of tree canopy cover. City of Fitchburg Ground Cover, Heat Island, and Carbon Sequestration Study: https://www.fitchburgwi.gov/DocumentCenter/View/27099/City-of-Fitchburg-Ground-Cover-Survey-and-Sequestration-Study-112923

12 US EPA, “What Climate Change Means for Wisconsin”; https://www.epa.gov/sites/default/files/2016-09/documents/climate-change-wi.pdf

13 Wisconsin Department of Natural Resources, Wisconsin Initiative on Climate Change Impacts; https://wicci.wisc.edu/2021-assessment-report/air/

14 Projections assume global greenhouse gas emissions are not reduced in line with the recommendations of the International Panel on Climate Change. Reductions in greenhouse gas emissions can positively effect the projected climate impacts, particularly in the second half of the century. Projections use climate model RCP 8.5 which is recommended by Woodshole Research Center as the best match through mid-century under current and stated policies with still highly plausible through 2100. Woods Hole Climate Research Center. "'Worst-case' CO2 emissions scenario is best for assessing climate risk and impacts to 2050." ScienceDaily. ScienceDaily, 4 August 2020. www.sciencedaily.com/releases/2020/08/200804085912.htm

Unless noted otherwise, projections are based on U.S. Climate Resilience Toolkit CLIMATE

EXPLORER, NOAA; https://crt-climate-explorer.nemac.org/

15 Assumes 60% of decrease of days <32° F occur during frost-free season with balance occurring during winter months

16 Argonne National Laboratory, Center for Climate Resilience and Decision Science, https://disgeoportal.egs.anl.gov/ClimRR/

17 Days Per Year with > 1" Rainfall

18 Increases are due to increased air conditioning needs. Calculations are based on US Environmental Protection Agency's "Climate Change Indicators: Residential Energy Use": https://www.epa.gov/climate-indicators/climate-change-indicators-residential-energy-use and an estimated average of 16.9% of total residential electric use for air conditioning based on US Energy Information Administration "Use of energy explained": https://www.eia.gov/energyexplained/use-of-energy/electricity-use-in-homes.php

19 Goldman School of Public Policy at the University of California Berkeley, Estimating Economic Damage from Climate Change in the United States, Solomon Hsiang et al: https://science.sciencemag.org/content/356/6345/1362

20 City of Fitchburg Climate Vulnerability Assessment: https://www.fitchburgwi.gov/DocumentCenter/View/27101/City-of-Fitchburg-Vulnerability-Assessment-111923

21 City of Fitchburg Community GHG Inventory, 2023 https://www.fitchburgwi.gov/DocumentCenter/View/27098/City-of-Fitchburg-GHG-Inventory-112023

22 UN Intergovernmental Panel on Climate Change (IPCC), AR6 Synthesis Report Climate Change 2023; https://www.ipcc.ch/report/ar6/syr/

23 US Global Change Research Program, US Climate Resilience Toolkit, https://toolkit.climate.gov/topics/equity

24 International City/County Management Association (ICMA), “Equity and Climate Action Planning”; https://icma.org/blog-posts/equity-and-climate-action-planning

Transportation and Land Use

1 National Renewable Energy Laboratory, Off-Road Vehicle Decarbonization and Energy Systems Integration: R&D Gaps and Opportunities; https://www.nrel.gov/docs/fy22osti/83525.pdf

2 US Energy Information Administration, International Energy Outlook 2016 https://www.eia.gov/outlooks/ieo/pdf/transportation.pdf

3 City of Fitchburg Community GHG Inventory, 2023 https://www.fitchburgwi.gov/DocumentCenter/View/27098/City-of-Fitchburg-GHG-Inventory-112023

4 US Department of Energy, FOTW #1313, October 23, 2023: Relationship between Vehicle Miles Traveled and Gasoline Prices Has Not Returned to Historical Pattern Following the Pandemic; https://www.energy.gov/eere/vehicles/articles/fotw-1313-october-23-2023-relationship-between-vehicle-miles-traveled-and

5 UCLA Institute of The Environment and Sustainability, "Electric vehicles improve air quality for everyone but have less impact in more polluted areas" https://www.ioes.ucla.edu/article/electric-vehicles-improve-air-quality-for-everyone-but-have-less-impact-in-more-polluted-areas/

6 Northwestern University, "Electric vehicle adoption improves air quality and climate outlook" https://news.northwestern.edu/stories/2019/04/electric-vehicle-adoption-improves-air-quality-and-climate-outlook/

7 University of Otago, "Cycle lanes and walkways cut car use, reduce emissions, study finds"; https://www.otago.ac.nz/news/newsroom/cycle-lanes-and-walkways-cut-car-use,-reduce-emissions,-study-finds

8 US Census accessed via Deloite Data USA: https://datausa.io/profile/geo/fitchburg-wi

9 US Census, On The Map: https://onthemap.ces.census.gov/

10 AAA "Your Driving Costs, 2023": https://newsroom.aaa.com/wp-content/uploads/2023/08/YDC-Fact-Sheet-FINAL-8.30.23-1.pdf

11 US Census https://data.census.gov/

12 TRB *Special Report 298: Driving and the Built Environment: Effects of Compact Development on Motorized Travel, Energy Use, and CO2 Emissions* Impacts of Land Use Patterns on Vehicle Miles Traveled Evidence from the Literature https://www.nap.edu/read/12747/chapter/5#88

13 The Influence of Urban Form on GHG Emissions in the U.S. Household Sector (Lee, S., and Lee, B. 2014) https://www.researchgate.net/publication/270952371_The_influence_of_urban_form_on_GHG_emissions_in_the_US_household_sector

14 New York Times, "E.V.s Start With a Bigger Carbon Footprint. But That Doesn't Last"; https://www.nytimes.com/2022/10/19/business/electric-vehicles-carbon-footprint-batteries.html

15 Michael L. Machala Et Al, Stanford University "Life cycle comparison of industrial-scale lithium-ion battery recycling and mining supply chains"; https://21672590.fs1.hubspotusercontent-na1.net/hubfs/21672590/Stanford%20University%20Life%20cycle%20comparison%20of%20industrial-scale%20lithium-ion%20battery%20recycling%20and%20mining%20supply%20chains.pdf

16 Scientific American, "Recycled Lithium-Ion Batteries Can Perform Better Than New Ones": https://www.scientificamerican.com/article/recycled-lithium-ion-batteries-can-perform-better-than-new-ones/

17 US Census data, https://datausa.io/profile/geo/fitchburg-wi

18 EV HUB, data for zip codes 53711 and 53575 https://www.atlasevhub.com/materials/state-ev-registration-data/

19 US Department of Energy Biodiesel Benefits and Considerations: https://afdc.energy.gov/fuels/biodiesel-benefits

20 Rolls Royce, "E-fuels powering a climate-neutral future": https://www.rolls-royce.com/media/our-stories/discover/2021/e-fuels-powering-climate-neutral-future.aspx

21 US Energy Information Administration, Carbon Dioxide Emissions Coefficients: https://www.eia.gov/environment/emissions/co2_vol_mass.php

22 US Department of Energy, "Driving More Efficiently"; https://www.fueleconomy.gov/feg/driveHabits.jsp

23 Catogen, "Benefits of Hybrid Cars for Fuel Consumption and Cost of Ownership" https://catagen.com/2022/08/31/blog-benefits-of-hybrid-cars-for-fuel-consumption-and-cost-of-ownership/

24 Electrifying, "What is a self charging hybrid": https://www.electrifying.com/blog/knowledge-hub/what-is-a-self-charging-hybrid

25 Consumer Reports, "Electric vehicle owners spending half as much on maintenance compared to gas-powered vehicle owners, finds new CR analysis": https://advocacy.consumerreports.org/press_release/electric-vehicle-owners-spending-half-as-much-on-maintenance-compared-to-gas-powered-vehicle-owners-finds-new-cr-analysis/

City of Fitchburg Sustainability Plan References

Buildings and Energy

1 City of Fitchburg Community GHG Inventory, 2023 https://www.fitchburgwi.gov/DocumentCenter/View/27098/City-of-Fitchburg-GHG-Inventory-112023

2 US Department of Energy, Residential Program Solution Center: https://rpsc.energy.gov/energy-data-facts

3 US Census https://data.census.gov/table/ACSDT5Y2022.B25036?q=Fitchburg%20city,%20Wisconsin&t=Year%20Structure%20Built

4 US General Services Administration "The Impact of High Performance Buildings" https://www.gsa.gov/governmentwide-initiatives/federal-highperformance-green-buildings/resource-library/integrative-strategies/the-impact-of-highperformance-buildings

5 US Department of Energy, Office of Energy Efficiency and Renewable Energy: https://www.energy.gov/eere/buildings/zero-energy-buildings-resource-hub

6 City of Fitchburg, residential and non-residential construction permit history, 2020, 2021, and 2022.

7 Social Explorer, Market Profile Data 2022 based on US Census American Census Survey; https://www.socialexplorer.com/data/EASI2025/documentation/7933fdf1-4c9b-4cb2-ad82-5a8e949ac78f

8 US Census Bureau ACS 5 year estimates; https://data.census.gov/table/ACSDT5Y2022.B25040?q=homes%20by%20heating%20fuel%20type&g=160XX00US5525950

9 Alliant Energy, Clean Energy Goals; https://www.alliantenergy.com/cleanenergy/ourenergyvision/responsibilityreport/cleanenergyvisiongoals and MGE Net Zero commitment: https://www.mgeenergy.com/esg/net-zero-carbon-electricity-by-2050

10 City of Fitchburg Community GHG Inventory, 2023; https://www.fitchburgwi.gov/DocumentCenter/View/27098/City-of-Fitchburg-GHG-Inventory-112023

11 US Department of Energy, Benefits of Residential Solar Electricity: https://www.energy.gov/energysaver/benefits-residential-solar-electricity

12 US Department of Energy, Solar and Resilience Basics: https://www.energy.gov/eere/solar/solar-and-resilience-basics

13 City of Fitchburg Renewable Energy Potentials Study, 2023: https://www.fitchburgwi.gov/DocumentCenter/View/27100/City-of-Fitchburg-Renewable-Potentials-Study-112923

14 Alliant Energy, Renewable Energy Partner: https://www.alliantenergy.com/cleanenergy/whatyoucando/renewableenergypartner

15 MG&E, Green Power Tomorrow; https://www.mge.com/our-environment/green-power/green-power-tomorrow

16 US Department of Energy, Renewable Energy Certificates: https://www.epa.gov/green-power-markets/renewable-energy-certificates-recs

17 ACEEE Understanding Energy Affordability: https://www.aceee.org/sites/default/files/energy-affordability.pdf

18 Jessel S, Sawyer S and Hernández D (2019) Energy, Poverty, and Health in Climate Change: A Comprehensive Review of an Emerging Literature. *Front. Public Health* 7:357. doi:

10.3389/fpubh.2019.00357: https://www.frontiersin.org/articles/10.3389/fpubh.2019.00357/full#h12

19 University of Houston, Climate Change and Energy Vulnerability of the American Poor; https://nlga.us/wp-content/uploads/uh-energy-white-paper-energy-burden-june-6-edit.pdf

20 Riva M, Kingunza Makasi S, O'Sullivan KC, Das RR, Dufresne P, Kaiser D, Breau S. Energy poverty: an overlooked determinant of health and climate resilience in Canada. Can J Public Health. 2023 Jun;114(3):422-431. doi: 10.17269/s41997-023-00741-0

21 Tony G. Reames, Michael A. Reiner, M. Ben Stacey, An incandescent truth: Disparities in energy-efficient lighting availability and prices in an urban U.S. county: https://www.sciencedirect.com/science/article/abs/pii/S0306261918302769

22 Portland State University. "Shifts to renewable energy can drive up energy poverty, study finds." ScienceDaily. ScienceDaily, 12 July 2019. https://www.sciencedaily.com/releases/2019/07/190712151926.htm

23 US Department of Energy, Low Income Energy Affordability Data: https://www.energy.gov/scep/low-income-energy-affordability-data-lead-tool-and-community-energy-solutions

24 US Department of Energy, "How Distributed Energy Resources Can Improve Resilience in Public Buildings: Three Case Studies and a Step-by-Step Guide": https://www.energy.gov/scep/slsc/articles/how-distributed-energy-resources-can-improve-resilience-public-buildings-three

Waste Management

1 US EPA, Zero Waste Case Study, San Francisco: https://www.epa.gov/transforming-waste-tool/zero-waste-case-study-san-francisco

2 Foodbank For The Heartland: https://foodbankheartland.org/ways-to-give/donate-food/

3 RecycleBank: https://recyclebank.com/

4 City of Fitchburg Community GHG Inventory, 2023; https://www.fitchburgwi.gov/DocumentCenter/View/27098/City-of-Fitchburg-GHG-Inventory-112023

5 City of Fitchburg Sustainability Baseline Assessment, 2023; https://www.fitchburgwi.gov/DocumentCenter/View/27102/City-of-Fitchburg-Sustainability-Baseline-and-Reduction-Recommendations-112923

6 US EPA Reducing and Reusing Basics; https://www.epa.gov/recycle/reducing-and-reusing-basics

7 Minnesota Chamber of Commerce, WasteWise program: https://www.mnchamber.com/sites/default/files/Waste%20Wise%20Annual%20Report.pdf

8 North Carolina State University Extension, How Your Business Can Cut Costs by Reducing Waste: https://content.ces.ncsu.edu/how-your-business-can-cut-costs-by-reducing-wastes

9 ReFed, A Roadmap To Reduce US Food Waste by 20 Percent: https://www.refed.com/downloads/ReFED_Report_2016.pdf

10 Agency for Toxic Substances and Disease Registry: https://www.atsdr.cdc.gov/hac/landfill/html/ch2.html

11 National League of Cities, "Policy to Achieve Circular Waste Management ";
https://www.nlc.org/wp-content/uploads/2021/11/CS-Executive-Summary_Beyond-Recycling-Brief-PDF.pdf

12 State of Wisconsin Department of Natural Resources, Solid Waste in Wisconsin Landfills, 2020-2021 Statewide Waste Characterization Study, South Central Region;
https://widnr.widencollective.com/portals/9locxp5m/SolidWasteinWisconsinLandfills

Water and Wastewater

1 US EPA, "Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts"; https://www.epa.gov/cira/social-vulnerability-report

2 California Department of Water Resources, Disadvantaged Community and Tribal Involvement Grant Program;
https://water.ca.gov/Work-With-Us/Grants-And-Loans/IRWM-Grant-Programs/Proposition-1/DAC-Involvement-Program

3 Leak Free Sacramento;
https://www.cityofsacramento.gov/utilities/water-conservation

4 Flint Michigan, Water Advisory Committee;
https://www.cityofflint.com/water-advisory-committee-to-be-formed-from-members-of-the-community-to-share-updates-and-concerns/

5 US Global Change Research Program, Fifth National Climate Assessment, Water Chapter;
https://nca2023.globalchange.gov/chapter/4/

6 Center for Climate and Energy Solutions, "Resilience Strategies for Drought";
https://www.c2es.org/wp-content/uploads/2018/10/resilience-strategies-for-drought.pdf

7 Aspen Public Radio, "How Landscaping Plays a Key Role in The Fight Against Climate Change";
https://www.aspenpublicradio.org/2023-10-17/how-landscaping-plays-a-key-role-in-the-fight-against-climate-change

8 Climate Central, "Overflow: Climate Change, Heavy Rain, And Sewage";
https://assets.climatecentral.org/pdfs/Overflow_sewagereport_update.pdf

9 Johnson T, Butcher J, Santell S, Schwartz S, Julius S, LeDuc S. A review of climate change effects on practices for mitigating water quality

impacts. J Water Clim Chang. 2022 Mar 22; https://doi.org/10.2166%2Fwcc.2022.363

10 Thomas C. Brown, Adaptation to Future Water Shortages in the United States Caused by Population Growth and Climate Change, Earth's Future, 28 February 2019; https://doi.org/10.1029/2018EF001091

11 City of Fitchburg Community GHG Inventory, 2023 https://www.fitchburgwi.gov/DocumentCenter/View/27098/City-of-Fitchburg-GHG-Inventory-112023

12 Madison Metropolitan Sewerage District data received by the City of Fitchburg

13 Water Research Foundation, Residential End Uses Of Water Version 2 2016: https://www.waterrf.org/research/projects/residential-end-uses-water-version-2

14 City of Fitchburg Sustainability Baseline Assessment, 2023; https://www.fitchburgwi.gov/DocumentCenter/View/27102/City-of-Fitchburg-Sustainability-Baseline-and-Reduction-Recommendations-112923

15 Argonne National Laboratory, Center for Climate Resilience and Decision Science, https://disgeoportal.egs.anl.gov/ClimRR/

16 Defined as Days Per Year with > 1" Rainfall, U.S. Climate Resilience Toolkit CLIMATE EXPLORER, NOAA; https://crt-climate-explorer.nemac.org/

17 WUFT, "Why the risk for flash flooding increases after a drought"; https://www.wuft.org/weather/2022-08-12/why-the-risk-for-flash-flooding-increases-after-a-drought

18 USGS, Evaluating chloride trends due to road-salt use and its impacts on water quality and aquatic organisms; https://www.usgs.gov/centers/upper-midwest-water-science-center/science/evaluating-chloride-trends-due-road-salt-use-and

19 Khatibi, F.S., Dedekorkut-Howes, A., Howes, M. *et al.* Can public awareness, knowledge and engagement improve climate change adaptation policies?. *Discov Sustain* 2**,** 18 (2021). https://doi.org/10.1007/s43621-021-00024-z

20 O'Neill, B.C., Jiang, L., KC, S. *et al.* The effect of education on determinants of climate change risks. *Nat Sustain* **3,** 520–528 (2020). https://doi.org/10.1038/s41893-020-0512-y

21 United Nations, Education is Key to Addressing Climate Change: https://www.un.org/en/climatechange/climate-solutions/education-key-addressing-climate-change

22 United Nations, UNICF Water Scarcity: https://www.unicef.org/wash/water-scarcity

Local Food and Agriculture

1 H. Nabipour Afrouzi, J. Ahmed, B. Mobin Siddique, N. Khairuddin, Ateeb Hassan, A comprehensive review on carbon footprint of regular diet and ways to improving lowered emissions, Results in Engineering, Volume 18, 2023; https://doi.org/10.1016/j.rineng.2023.101054

2 Conner, David & Knudson, William & Hamm, Michael & Peterson, H.. (2008). The Food System as an Economic Driver: Strategies and Applications for Michigan. https://www.researchgate.net/publication/247521128_The_Food_System_as_an_Economic_Driver_Strategies_and_Applications_for_Michigan

3 North Carolina State Extension, Research & Benefits of Community Gardens: https://nccommunitygardens.ces.ncsu.edu/resources-3/nccommunitygardens-research/

4 USDA Climate Indicators for Agriculture: https://www.usda.gov/sites/default/files/documents/climate_indicators_for_agriculture.pdf

5 US Department of Health, Office of Disease Prevention and Health Promotion: https://www.healthypeople.gov/2020/topics-objectives/topic/social-determinants-health/interventions-resources/food-insecurity

6 US Global Change Research Program, Fifth National Climate Assessment, Agriculture, Food Systems, and Rural Communities Chapter; https://nca2023.globalchange.gov/chapter/11/

7 USDA "Access to Affordable, Nutritious Food Is Limited in "Food Deserts"; https://www.ers.usda.gov/amber-waves/2010/march/access-to-affordable-nutritious-food-is-limited-in-food-deserts/

8 Addy Yater, Correlation Between Food Deserts and Fast-food Restaurants; https://storymaps.arcgis.com/stories/c85cf89d1516498d9645c325b3f5d814

9 MSU Center For Regional Food Systems, "Delivering More Than Food: Understanding And Operationalizing Racial Equity In Food Hubs"; https://www.nutritionincentivehub.org/media/icjh33lj/delivering-more-than-food-understanding-and-operationalizing-racial-equity-in-food-hubs.pdf

10 The Food Trust, "Why The Farm Bill Matters For Greater Philadelphia"; https://thefoodtrust.org/wp-content/uploads/2022/07/why-the-farm-bill-matters-for-greater-philadelphia.original.pdf

11 New York City Department of Health & Mental Hygiene, "New York City Healthy Bodegas Initiative"

https://www.nyc.gov/assets/doh/downloads/pdf/cdp/healthy-bodegas-rpt2010.pdf

12 Rachel Dannefer, et al, "Healthy Bodegas: Increasing and Promoting Healthy Foods at Corner Stores in New York City" Am J Public Health. Published online 2012 October. doi: 10.2105/AJPH.2011.300615

13 Daily Table; https://www.dailytable.org/

14 Zaman, M. *et al.* (2021). Climate-Smart Agriculture Practices for Mitigating Greenhouse Gas Emissions. In: Zaman, M., Heng, L., Müller, C. (eds) Measuring Emission of Agricultural Greenhouse Gases and Developing Mitigation Options using Nuclear and Related Techniques. Springer, Cham. https://doi.org/10.1007/978-3-030-55396-8_8

15 Suparak Gibson, Aislin. 2022. The Underground Economy: Regenerative Farming's Hidden Economic, Ecological, and Social Value. Master's thesis, Harvard University Division of Continuing Education; https://nrs.harvard.edu/URN-

3:HUL.INSTREPOS:37371589

16 McKinsey and Company, Reducing Agriculture Emissions Through Improved Farming Practices; https://www.mckinsey.com/industries/agriculture/our-insights/reducing-agriculture-emissions-through-improved-farming-practices

17 USDA, Why Should You Care About Food Waste: https://www.usda.gov/foodlossandwaste/why

18 State of Wisconsin Department of Natural Resources, Solid Waste in Wisconsin Landfills, 2020-2021 Statewide Waste Characterization Study, South Central Region; https://widnr.widencollective.com/portals/9locxp5m/SolidWasteinWisconsinLandfills

19 City of Fitchburg Community GHG Inventory, 2023 https://www.fitchburgwi.gov/DocumentCenter/View/27098/City-of-Fitchburg-GHG-Inventory-112023

20 ReFed, A Roadmap To Reduce US Food Waste by 20 Percent: https://www.refed.com/downloads/ReFED_Report_2016.pdf

21 Lengnick, Laura. (2015). The vulnerability of the US food system to climate change. Journal of Environmental Studies and Sciences. https://www.researchgate.net/publication/282499666_The_vulnerability_of_the_US_food_system_to_climate_change

22 The World, "US lost 11 million acres of farmland to development in past 2 decades" ; https://theworld.org/stories/2020-08-07/us-lost-11-million-acres-farmland-development-past-2-decades

23 Farm Journal "Surface Pressure: U.S. Losing Farmland at Alarming Rate" ; https://www.agweb.com/news/business/farmland/surface-pressure-us-losing-farmland-alarming-rate

24 American Farmland Trust, Farms Under Threat: Biodiversity and Agriculture; https://farmland.org/project/biodiversity-and-agriculture/

Greenspace and Ecosystems

1 City of Pittsburgh Equitable Street Tree Investment Strategy; https://apps.pittsburghpa.gov/redtail/images/13230_final_Equitable_Street_Tree_Investment_Strategy_-_2_24_21_-_apc.pdf

2 Urban Land Institute, "Pavement to Parks"; https://knowledge.uli.org/-/media/files/research-reports/2020/pavement_to_parks_final.pd

3 New York City, Green Roof Tax Abatement; https://www.nyc.gov/site/finance/property/landlords-green-roof.page

4 US EPA, Using Trees and Vegetation to Reduce Heat Islands; https://www.epa.gov/heatislands/using-trees-and-vegetation-reduce-heat-islands

5 Dahlia Stott, et al, Interactions with Nature, Good for the Mind and Body: A Narrative Review, Int J Environ Res Public Health. 2024 Mar; 21(3): 329. Published online 2024 Mar 12; https://www.mdpi.com/1660-4601/21/3/329

6 US EPA, Throwing Shade Exploring Benefits of Trees; https://www.epa.gov/sciencematters/throwing-shade-exploring-benefits-trees

7 US EPA, Landscaping with Native Plants; https://archive.epa.gov/greenacres/web/html/conf_knwldge.html

8 Audubon, Why Native Plants Matter; https://www.audubon.org/content/why-native-plants-matter

9 Comparison of impervious surface area and normalized difference vegetation index as indicators of surface urban heat island effects in Landsat imagery. Fi Yuan and Marvin Bauer, February 2007: https://rs.umn.edu/sites/rs.umn.edu/files/Urban_heat_island--Impervious__RSE_paper.pdf

10 Francisco J. Escobedo, Timm Kroeger, John E. Wagner, Urban forests and pollution mitigation: Analyzing ecosystem services and disservices, Environmental Pollution, Volume 159, Issues 8–9, 2011: https://www.sciencedirect.com/science/article/abs/pii/S0269749111000327

11 T Elmqvist, H Setälä, SN Handel, S van der Ploeg, J Aronson, JN Blignaut, E Gómez-Baggethun, DJ Nowak, J Kronenberg, R de Groot, Benefits of restoring ecosystem services in urban areas, Current Opinion in Environmental Sustainability, Volume 14, 2015: https://www.sciencedirect.com/science/article/pii/S1877343515000433

12 USDA Forest Service, Carbon Storage and Sequestration by Urban Trees in the USA: https://www.nrs.fs.fed.us/pubs/5521

13 US EPA, Using Trees and Vegetation to Reduce Heat Islands: https://www.epa.gov/heatislands/using-trees-and-vegetation-reduce-heat-islands

14 USDA Forest Service, Trees Reduce Building Energy Use in US Cities: https://www.nrs.fs.fed.us/news/release/trees-reduces-building-energy-use

15 City of Fitchburg Ground Cover, Heat Island, and Carbon Sequestration Study: https://www.fitchburgwi.gov/DocumentCenter/View/27099/City-of-Fitchburg-Ground-Cover-Survey-and-Sequestration-Study-112923

16 US EPA, Green Landscaping: Greenacres, a Source Book on Natural Landscaping for Public Officials: https://archive.epa.gov/greenacres/web/html/chap2.html

17 Fight Climate Change at Home: Landscaping with Native Grasses, Lindsay Ifill: https://www.wildrootsnj.com/ecological-landscaping-with-native-grasses-climate-

change/

18 Tallgrass Ontario: Tallgrass Prairie and Carbon Sequestration: https://tallgrassontario.org/wp-site/carbon-sequestration/

19 University of Minnesota, "The Potential of Turfgrass to Sequester Carbon and Offset Greenhouse Gas Emissions"; https://turf.umn.edu/news/potential-turfgrass-sequester-carbon-and-offset-greenhouse-gas-emissions

20 Resource Central, Unearth the Turf: Outdoor Water Savings; https://resourcecentral.org/unearth-the-turf-outdoor-water-savings/

21 US EPA, Know Your Roots; https://cfpub.epa.gov/npstbx/files/KSMO_KnowYourRoots.pdf

22 US EPA, Climate Change and Heat Islands: https://www.epa.gov/heatislands/climate-change-and-heat-islands

23 City of Fitchburg Climate Vulnerability Assessment: https://www.fitchburgwi.gov/DocumentCenter/View/27101/City-of-Fitchburg-Vulnerability-Assessment-111923

24 The Nature Conservancy, "Invasive Species Threaten Climate Change Preparedness and Resilience"; https://www.nature.org/en-us/newsroom/isac-invasive-species-advisory-committee-climate-change-resilience/

25 Fourth National Climate Assessment, Chapter 7: Ecosystems, Ecosystem Services, And Biodiversity; https://nca2018.globalchange.gov/chapter/7/

26 University of Zurich. "Diverse landscapes are more productive and adapt better to climate change." ScienceDaily. ScienceDaily, 4 September 2017; www.sciencedaily.com/releases/2017/09/170904165641.htm

27 International Union for Conservation of Nature, "Embracing biodiversity: Paving the way for nature-inclusive cities"; https://www.iucn.org/story/202305/embracing-biodiversity-paving-way-nature-inclusive-cities

28 Terrascope, "Why Urban Parks & Wildlife Corridors Are a Legitimate Solution"; https://terrascope2024.mit.edu/?page_id=193

29 World Health Organization, "Urban green spaces and health"; https://iris.who.int/handle/10665/345751

30 US EPA, "Reduce Urban Heat Island Effect"; https://www.epa.gov/green-infrastructure/reduce-urban-heat-island-effect

31 World Health Organization, BreathLife Campaign, "Green Spaces Improve Air Quality: Integrating Plants Into City Design"; https://breathelife2030.org/news/green-spaces-improve-air-quality/

32 Braubach, M., Egorov, A., Mudu, P., Wolf, T., Ward Thompson, C., Martuzzi, M. (2017). Effects of Urban Green Space on Environmental Health, Equity and Resilience. In: Kabisch, N., Korn, H., Stadler, J., Bonn, A. (eds) Nature-Based Solutions to Climate Change Adaptation in Urban Areas. Theory and Practice of Urban Sustainability Transitions. Springer, Cham. https://doi.org/10.1007/978-3-319-56091-5_11

33 CityHealth, an initiative of the de Beaumont Foundation and Kaiser Permanente, "Greenspace: Local Policies Building Healthy, Resilient, and Equitable Communities"; https://www.cityhealth.org/resource/greenspace-overview/

Health and Safety

1 US Global Change Research Program, Fifth National Climate Assessment; https://nca2023.globalchange.gov/

2 National Centers for Disease Control, Climate Effects on Health; https://www.cdc.gov/climate-health/php/effects/

3 US EPA, "EPA Report Shows Disproportionate Impacts of Climate Change on Socially Vulnerable Populations in the United States" https://www.epa.gov/newsreleases/epa-report-shows-disproportionate-impacts-climate-change-socially-vulnerable

4 US Global Change Research Program, Climate and Health Assessment, Populations of Concern: https://health2016.globalchange.gov/populations-concern

5 US EPA, "What Climate Change Means for Wisconsin"; https://www.epa.gov/sites/default/files/2016-09/documents/climate-change-wi.pdf

6 National Institute of Environmental Heath Sciences, Water-Related Illnesses; https://www.niehs.nih.gov/research/programs/climatechange/health_impacts/waterborne_diseases

7 National Oceanic and Atmospheric Administration "Drought in America: Slow moving, far reaching "; https://www.noaa.gov/explainers/drought-in-america-slow-moving-far-reaching

8 Fouque, F., Reeder, J.C. Impact of past and on-going changes on climate and weather on vector-borne diseases transmission: a look at the evidence. Infect Dis Poverty 8, 51 (2019). https://doi.org/10.1186/s40249-019-0565-1

9 Paz S (2024) Climate change: A driver of increasing vector-borne disease transmission in non-endemic areas. PLoS Med 21(4): e1004382. https://doi.org/10.1371/journal.pmed.1004382

10 Hayes, K., Blashki, G., Wiseman, J. *et al.* Climate change and mental health: risks, impacts and priority actions. *Int J Ment Health Syst* 12, 28 (2018). https://doi.org/10.1186/s13033-018-0210-6

11 World Health Organization, Why mental health is a priority for action on climate change; https://www.who.int/news/item/03-06-2022-why-mental-health-is-a-priority-for-action-on-climate-change

12 American Psychiatric Association, Climate Change and Mental Health Connections; https://www.psychiatry.org/patients-families/climate-change-and-mental-health-connections

13 City of Portland, Cooling Portland; https://www.portland.gov/bps/cleanenergy/about-cooling-portland

14 City of Burnsville, Grow Burnsville: https://burnsvillemn.gov/grow

15 US EPA, "Climate Change Impacts on Air Quality"; https://www.epa.gov/climateimpacts/climate-change-impacts-air-quality

16 City of Fitchburg Climate Vulnerability Assessment: https://www.fitchburgwi.gov/DocumentCenter/View/27101/City-of-Fitchburg-Vulnerability-Assessment-111923

17 Khatibi, F.S., Dedekorkut-Howes, A., Howes, M. *et al.* Can public awareness, knowledge and engagement improve climate change adaptation policies?. *Discov Sustain* 2, 18 (2021). https://doi.org/10.1007/s43621-021-00024-z

18 O'Neill, B.C., Jiang, L., KC, S. *et al.* The effect of education on determinants of climate change risks. *Nat Sustain* 3, 520–528 (2020). https://doi.org/10.1038/s41893-020-0512-y

19 United Nations, Education is Key to Addressing Climate Change: https://www.un.org/en/climatechange/climate-solutions/education-key-addressing-climate-change

20 Adaptive Capacity for Climate Change in Canadian Rural Communities, Ellen Wall & Katia Marzall: https://www.tandfonline.com/doi/abs/10.1080/13549830600785506

21 Eric Klinenberg, Heat Wave A Social Autopsy of Disaster in Chicago; https://press.uchicago.edu/Misc/Chicago/443213in.html

34 Adaptive Capacity for Climate Change in Canadian Rural Communities, Ellen Wall & Katia Marzall: https://www.tandfonline.com/doi/abs/10.1080/13549830600785506

35 Eric Klinenberg, Heat Wave A Social Autopsy of Disaster in Chicago; https://press.uchicago.edu/Misc/Chicago/443213in.html

Sustainable Economy

1 Green Opportunities; https://www.linkedin.com/company/green-opportunities

2 Santa Fe Business Incubator: https://sfbi.net/

3 PUSH Buffalo, Affordable Housing Program: https://www.pushbuffalo.org/affordable-housing/

4 Martinich, J., Crimmins, A. Climate damages and adaptation potential across diverse sectors of the United States: https://www.nature.com/articles/s41558-019-0444-6

5 The Economist, What is The Economic Cost of Covid-19?: https://www.economist.com/finance-and-economics/2021/01/09/what-is-the-economic-cost-of-covid-19

6 City of Fitchburg Climate Vulnerability Assessment: https://www.fitchburgwi.gov/DocumentCenter/View/27101/City-of-Fitchburg-Vulnerability-Assessment-111923

7 City of Fitchburg Community GHG Inventory, 2023 https://www.fitchburgwi.gov/DocumentCenter/View/27098/City-of-Fitchburg-GHG-Inventory-112023

8 Climate Xchange, Wisconsin considers the social cost of carbon; https://climate-xchange.org/2020/02/06/wisconsin-considers-the-social-cost-of-carbon-with-newly-filed-bill/

9 US EPA, Quantifying the Multiple Benefits of Energy Efficiency and Renewable Energy: A Guide for State and Local Governments: https://www.epa.gov/sites/default/files/2018-07/documents/mbg_1_multiplebenefits.pdf

10 Michael Sivak and Brandon Schoettle, Relative Costs of Driving Electric and Gasoline

Vehicles in the Individual U.S. States: http://websites.umich.edu/~umtriswt/PDF/SWT-2018-1_Abstract_English.pdf

11 Conner, David & Knudson, William & Hamm, Michael & Peterson, H.. (2008). The Food System as an Economic Driver: Strategies and Applications for Michigan. https://www.researchgate.net/publication/247521128_The_Food_System_as_an_Economic_Driver_Strategies_and_Applications_for_Michigan

12 C40 Cities, C40 Knowledge Hub, "The green jobs advantage: How climate-friendly investments are better job creators" ; https://www.c40knowledgehub.org/s/article/The-green-jobs-advantage-How-climate-friendly-investments-are-better-job-creators?language=en_US

13 OECD Report for the G7 Environment Ministers, Employment Implications of Green Growth: Linking jobs, growth, and green policies; https://www.oecd.org/environment/Employment-Implications-of-Green-Growth-OECD-Report-G7-Environment-Ministers.pdf

14 New Climate Economy, Unlocking The Inclusive Growth Story of The 21st Century: Accelerating Climate Action in Urgent Times: https://newclimateeconomy.report/2018/wp-content/uploads/sites/6/2018/09/NCE_2018_FULL-REPORT.pdf

15 United Nations, Financing Climate: https://www.un.org/en/climatechange/raising-ambition/climate-finance

16 World Resources Institute, 10 Charts Show the Economic Benefits of US Climate Action: https://www.wri.org/insights/10-charts-show-economic-benefits-us-climate-action

17 NREL, State-by-State Clean Energy Jobs Potential Projections; https://www.nrel.gov/state-local-tribal/state-employment-projection-support.html

18 Brookings Institute, Advancing Inclusion Through Clean Energy Jobs: https://www.brookings.edu/research/advancing-inclusion-through-clean-energy-jobs/

19 Brookings Institute, "Why green jobs plans matter and where US cities stand in implementing them"; https://www.brookings.edu/articles/why-green-jobs-plans-matter-and-where-u-s-cities-stand-in-implementing-them/

20 National League of Cities, "5 Strategies for Developing a Local Green Jobs Plan"; https://www.nlc.org/article/2024/04/02/5-strategies-for-developing-a-local-green-jobs-plan/

21 US Small Business Administration, Office of Advocacy, "Small Businesses Generate 44 Percent Of U.S. Economic Activity"; https://advocacy.sba.gov/2019/01/30/small-businesses-generate-44-percent-of-u-s-economic-activity/

22 Forbes, "How Small Businesses Drive The American Economy"; https://www.forbes.com/sites/forbesbusinesscouncil/2022/03/25/how-small-businesses-drive-the-american-economy/?sh=63abb1d44169

23 Time, "How Small Businesses Can Have a Big Impact in the Climate Fight" ; https://time.com/6213434/climate-change-action-companies-businesses/

24 United Nations, "Small businesses unprepared for pandemic-sized climate shock 'every decade"; https://news.un.org/en/story/2021/06/1094582

25 Union of Concerned Scientists, "When Rising Seas Hit Home"; https://www.ucsusa.org/resources/when-

rising-seas-hit-home

26 Internal Displacement Monitoring Centre, Global Internal Displacement Database; https://www.internal-displacement.org

27 Modeling migration patterns in the USA under sea level rise, Robinson C, Dilkina B, Moreno-Cruz J (2020. PLOS ONE 15(1): e0227436. https://doi.org/10.1371/journal.pone.0227436

28 USAID, "Are Cities Ready for Growing Climate-Related Migration?"; https://urban-links.org/insight/are-cities-ready-for-growing-climate-related-migration/

29 National League of Cities, "The Next American Migration: What Cities Should Know About Climate Change and Populations on the Move"; https://www.nlc.org/resource/the-next-american-migration-what-cities-should-know-about-climate-change-and-populations-on-the-move/

30 US Chamber of Commerce, "How Public-Private Partnerships Can Advance Climate Action"; https://www.uschamber.com/on-demand/small-business/how-public-private-partnerships-can-advance-climate-action

31 Brookings Institute, "How US cities are finding creative ways to fund climate progress"; https://www.brookings.edu/articles/how-us-cities-are-finding-creative-ways-to-fund-climate-progress

32 Swiss Re, World Economy Set to Lose up to 18% GDP From Climate Change if no Action Taken, Reveals Swiss Ri Institute's Stress-Test Analysis https://www.swissre.com/media/news-releases/nr-20210422-economics-of-climate-change-risks.html

Appendix E
Acknowledgements

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City of Fitchburg Project Lead

Phil Grupe Sustainability Specialist, City of Fitchburg

Sustainability Planning Team

Peter Barbiaux	Resident
Linda Brewer	Highlands of Seminole Neighborhood Association
Jason Burkins	Resident
Cristina Carvajal	Wisconsin Ecolatinos
Jay DeNovo	Resident
Joey Dunscombe	Four Winds Farm
Susan Easterday	Parks Commission
Rick Eilertson	Resident
Dave Evans	Resident
Tracy Foss	Assistant Director of Public Works, City of Fitchburg
Jacqueline Freidel	Resident
Ron Golesh	Resident
Linda Gorchels	Resident
Joe Goss	Resident
Phil Grupe	Sustainability Specialist, City of Fitchburg
Kevin Grzebielski	Resident
Jay Hutchinson	Four Winds Farm
Kelly Jetzer	Resident
Josh Knackert	Resident
Nicole Lloyd	Resident
Nathan Lorentz	Resident
David Luepke	Resident
MaryAnn McKenzie	Four Winds Farm
Dhanalakshmi Namasivayam	Resident
Jan Niewold	Resident
Katie Richgels	Resident
Bradley Sippel	Community Development Planner, City of Fitchburg
Judith Stadler	Resident
Carol Waller	Resident
Lisa Zawadsky	Resident

Consultant Team

making change personal

paleBLUEdot LLC

www.paleBLUEdot.llc

Prepared By:

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www.paleBLUEdot.llc