**A G E N D A**
**CITY OF WAUPUN BOARD OF PUBLIC WORKS AND FACILITIES COMMITTEE**
**Waupun City Hall – 201 E. Main Street, Waupun WI**
**Tuesday, October 10, 2023 at 4:30 PM**

The Board of Public Works and Facilities Committee will meet in person, virtual, and teleconference. Instructions to join the meeting are provided below:

Join Zoom Meeting
https://us02web.zoom.us/j/85041232418?pwd=VFNaV3ZlcGhuNjlaNWlWTjBmd21ZUT09

Meeting ID: 850 4123 2418
Passcode: 178653
By Phone: (312) 626-6799 US (Chicago)

**CALL TO ORDER**

**ROLL CALL**

**PERSONS WISHING TO ADDRESS THE BOARD OF PUBLIC WORKS**--*State name, address, and subject of comments. (2 Minutes)*

***No Public Participation after this point.***

**FUTURE MEETINGS AND GATHERING INVOLVING THE BOARD OF PUBLIC WORKS**

**CONSIDERATION - ACTION**
1. Approve minutes of the September 12, 2023 meeting.
2. City of Waupun Energy Plan Final report
3. Community Garden Location
4. City property West of Rosewood Dr.

**ADJOURNMENT**
*Upon reasonable notice, efforts will be made to accommodate disabled individuals through appropriate aids and services. For additional information, contact the City Clerk at 920-324-7915.*

**M I N J U T E S**
**CITY OF WAUPUN BOARD OF PUBLIC WORKS AND FACILITIES COMMITTEE**
**Waupun City Hall – 201 E. Main Street, Waupun WI**
**Tuesday, September 12, 2023 at 4:30 PM**

Chairman Peter Kaczmarki called the meeting to order at 4:30 PM

ROLL CALL Roll call was taken: Alderpersons—Peter Kaczmarski, William Langford, Mike Matoushek (online), Citizens—Dave Rens, Ex-officio—DPW Director Jeff Daane; Absent and excused: Citizens - Gregg Zonnefeld, Andrew Sullivan, Dale Heeringa

Also present are Mayor Rohn Bishop, City Administrator Kathy Schlieve, and Recreation Director Rachel Kaminski.

No public present to address the Board of Public Works.

Next meeting will be on Tuesday, October 12, 2023 at 4:30PM.

**CONSIDERATION - ACTION**

1. Approve minutes of the July 11, 2023 meeting.
    a. Motion Langford, second .Matoushek to approve Board of Public Works minutes from July 11, 2023 meeting. Carried unanimously.

2. Review Capital Improvement ratings for 2024 projects
    a. Jeff Daane provides an overview of committee member rankings of capital improvement projects and insight into proposed 2024 capital improvement budget. Daane indicates that the information was used to put together the 2024 capital budget. Kaczmarski requests that an update be provided once the budget is approved.

3. Canoe/Kayak launch survey results and future location
    a. Jeff Daane provides the results of a community survey to locate the newest canoe kayak launch. Survey results reflect that the preferred site is below the dam along Gateway Drive. Motion Langford, second Matoushek to approve the location. Carried unanimously.

4. Waupun Hockey information per agreement with the City of Waupun
    a. Lucas Dawson provided an overview of Hockey program in accordance with the agreement held with the City. Ice setup will begin on Sunday, September 17 and be installed through end of March 2024. Matoushek questioned amount of public skate. Dawson comments that they worked to add ice time for public skate. There is no Bantam team this year and ice time is also sold to Fond du Lac skaters. Motion Matoushek, second Rens to approve information as presented. Carried unanimously.

5. Fall yard waste cleanup dates
    a. Jeff Daane presents schedule for fall yard waste cleanup to be held October 9 through November 13 2023, with all remaining yard waste needing to be curbside by 7 am on November 13, 2023. Rens questions if all areas of community get equal amounts of pickup. Discussion on daily maps to track pickup, ensuring everyone gets equal amounts of time. Motion Matoushek, second Langford to approve fall yard waste cleanup dates as presented. Carried unanimously.

6. Asphalt Paving Contract Wilcox St. recommendation to council
    a. Jeff Daane indicates that the City did not receive a WisDOT grant applied for to repair Wilcox St. The City will use available funds in the 2023 budget to complete a mill and overlay on the street. Daane

reviews bids received at a bid opening on September 12. Kartechner Brothers is the lowest bidder at $43,017. Motion Matoushek, second Langford to recommend approval of a contract with Kartechner Brothers per bid document. Roll call vote taken. Carried 4-0.

7. Remove 2 hour parking on E. Jefferson Street between S. Madison St. and Carrington St.
    a. Jim Hepp is present and requests that the city evaluate and remove 2-hour parking restrictions on the section of E Jefferson St between S. Madison St and Carrington St. After evaluation, Jeff Daane is recommending that the City remove the eastern portion of the south side of E Jefferson St between S. Madison and Carrington Streets, with the exception of spaces designated as 2-hour parking along FVSBank, approximately 100 feet from intersection. Motion Matoushek, second Langford to approve recommendation and send to Council for review and approval. Carried unanimously.

Motion Matoushek, second Rens to adjourn the meeting. Carried unanimously. Meeting adjourned at 5:05 p.m.

# AGENDA SUMMARY SHEET

**MEETING DATE:** October 10, 2023

**TITLE:** City of Waupun Energy Plan Final report

**AGENDA SECTION:** Discussion

**PRESENTER:** Jeff Daane

| **DEPARMTENT GOAL(S) SUPPORTED** *(if applicable)* | **FISCAL IMPACT** | |
|---|---|---|
| | | |

**ISSUE SUMMARY**

For more than a decade, the City of Waupun has been committed to lowering its energy use and carbon impact. In 2009, the City signed a resolution for a 25% reduction in energy use by 2025. In 2018, the City reconfirmed its commitment with a resolution to reduce energy use in municipal operations by 5% in five years, and then quickly met that goal by upgrading lighting across city buildings.
To build on its previous efforts and identify additional potential energy cost savings, the City was awarded a planning grant from the State Office of Energy Innovation (OEI) at the Public Service Commission in 2022. Over the past year, the City of Waupun worked with Slipstream and Waupun Utilities, to develop a municipal energy plan that identified near-term cost-effective energy saving opportunities.
The project process included:

- Collection of energy use and cost data from buildings and fleet
- Compilation of energy data to develop energy and emissions baselines
- Energy assessment walkthroughs at three city facilities
- Analysis of energy data, along with building and vehicle information to identify cost-savings opportunities for renewable energy, fleet conversions, and building energy efficiency

Creating an inventory of current energy use, costs, and carbon by source is a vital first step in a planning process. The energy profile allows for identification of savings opportunities and serves as a baseline to use when tracking future progress. The team started by inventorying the number of buildings and fleet vehicles, and associated energy use and costs

**STAFF RECCOMENDATION:**

**ATTACHMENTS:**
Power point
Energy plan final report

**RECCOMENDED MOTION:**

**1.**

| AGENDA ITEM: | #14 |
|---|---|

| DATE: | MAY 8, 2018 |
|---|---|

# Waupun Energy Plan

## Final Results

October 10, 2023

# Agenda

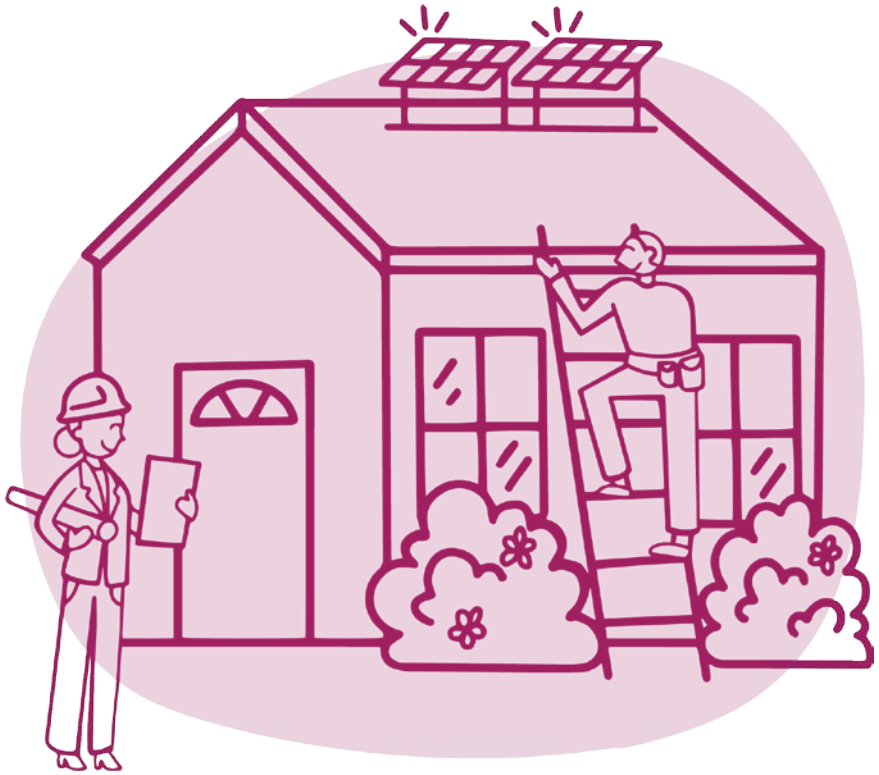
## Project Background

## Baseline Energy Use

## Recommendations

- Building Energy Efficiency
- Solar Opportunities
- Municipal Fleet
- Funding

## Questions



# Objectives

Develop a baseline energy profile of municipal operations

Create an actionable energy plan that identifies 10 to 15 near-term and medium-term opportunities for building energy efficiency and fleet

Identify policies to ensure continued progress

# Overview of Process

## Collect Data

- Previous energy-related activities
- Electricity and natural gas use for buildings
- Gasoline and diesel purchases
- Building equipment inventory
- Goals of energy planning

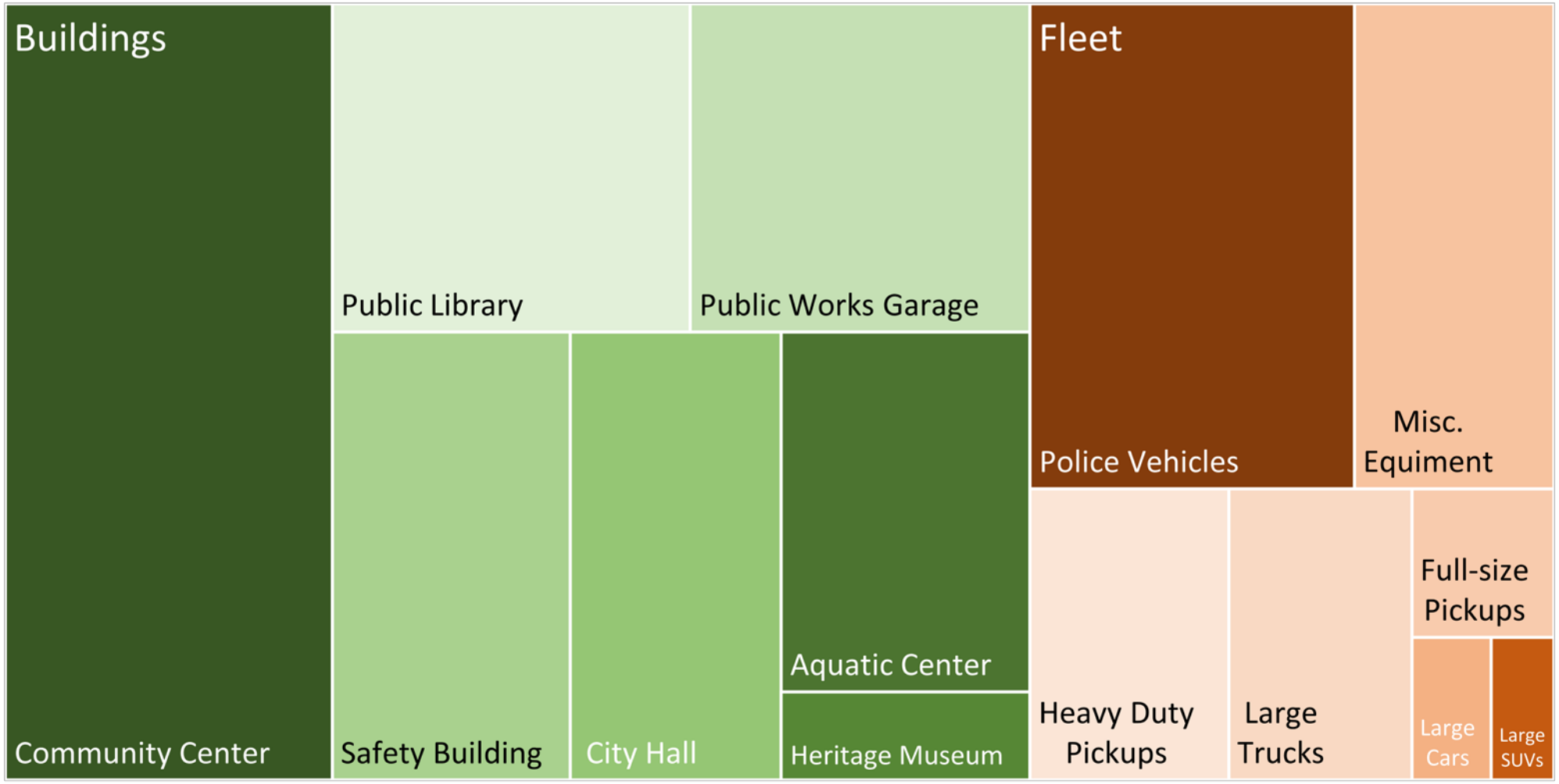
## Analyze Data
## Assess Buildings

- Development of energy use, cost, and emissions baseline for city operations
- Walkthrough energy audits of selected city buildings

## Recommend energy saving opportunities

- Analysis of city data to identify cost saving opportunities:
  - Solar installation
  - Fleet conversion
  - Building energy efficiency
  - Internal policies

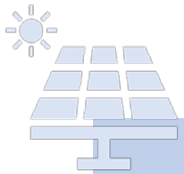
# Current Energy Use - Baseline



# Recommendations

## Energy Efficiency

- Continue **ongoing benchmarking** of building performance
- Implement recommended measures for audited buildings.
- Adopt standard **operating procedures** across buildings.
- Institute standard **purchasing policies** for building equipment across all buildings.



## Solar + Energy Storage

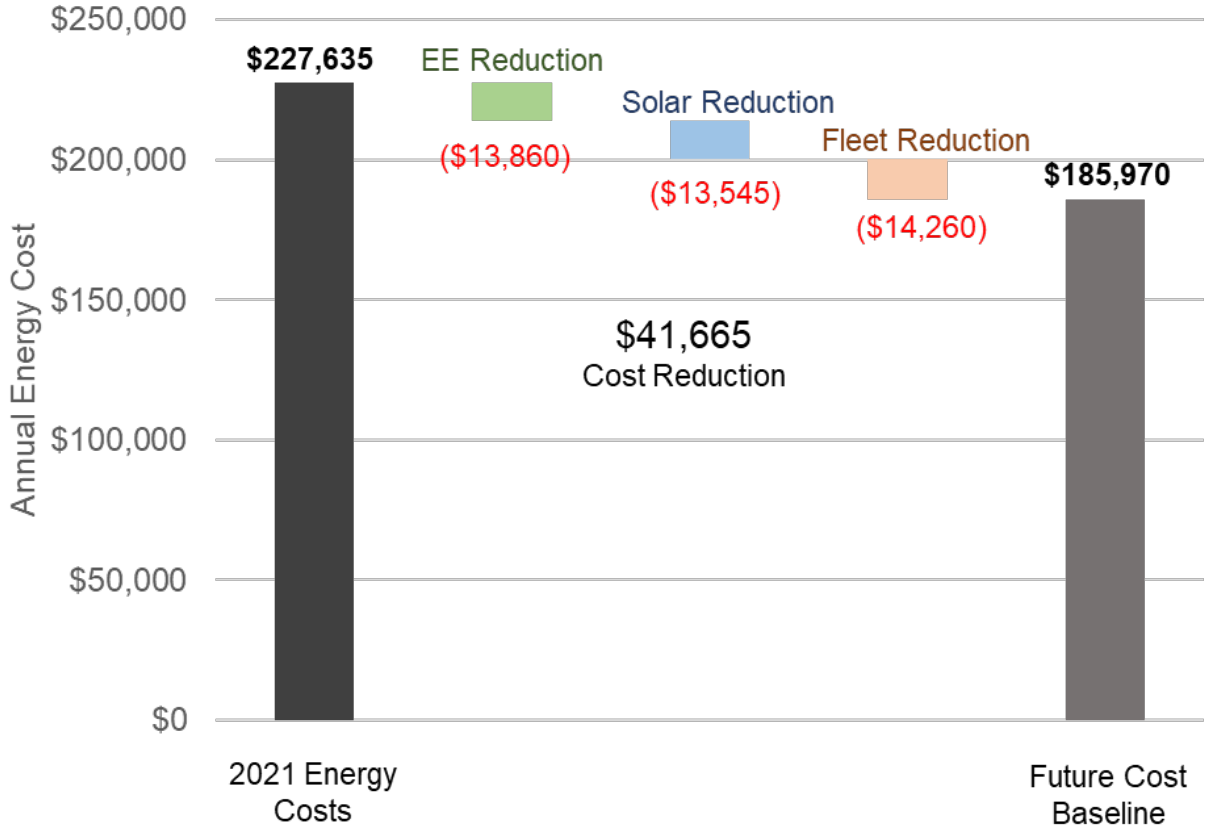
- Install **100-150 kW of solar** at city buildings offsetting 15% to 20% of site electricity use.
- Require all new construction for city buildings to **be solar-ready**.
- Consider **battery installations** at time of generator replacement

## Vehicles

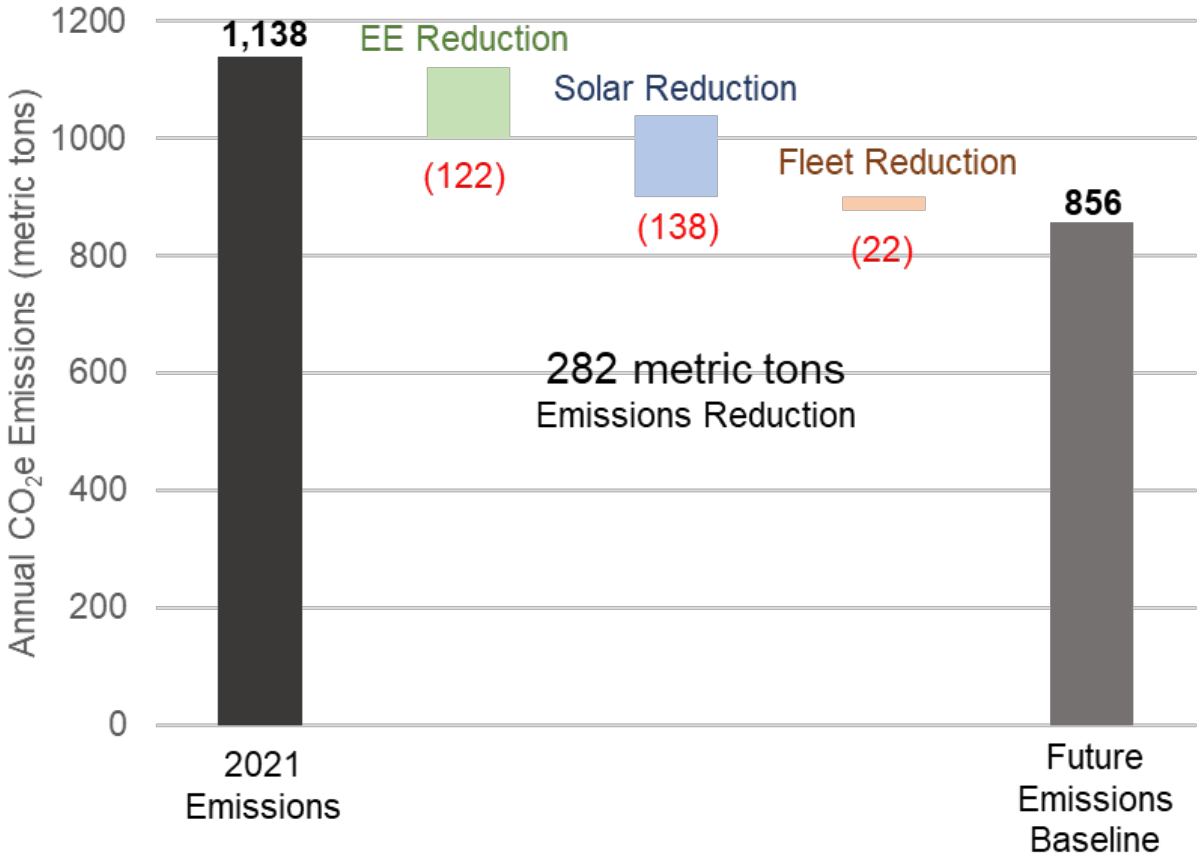
- Pilot **two to three electric vehicles** in the municipal fleet.
- Use **estimated total cost** of vehicle ownership to guide vehicle purchasing decisions.
- Consider how the city can advance municipal and public **EV charging**

# Potential Cost and $CO_2$ Reductions

## Cost

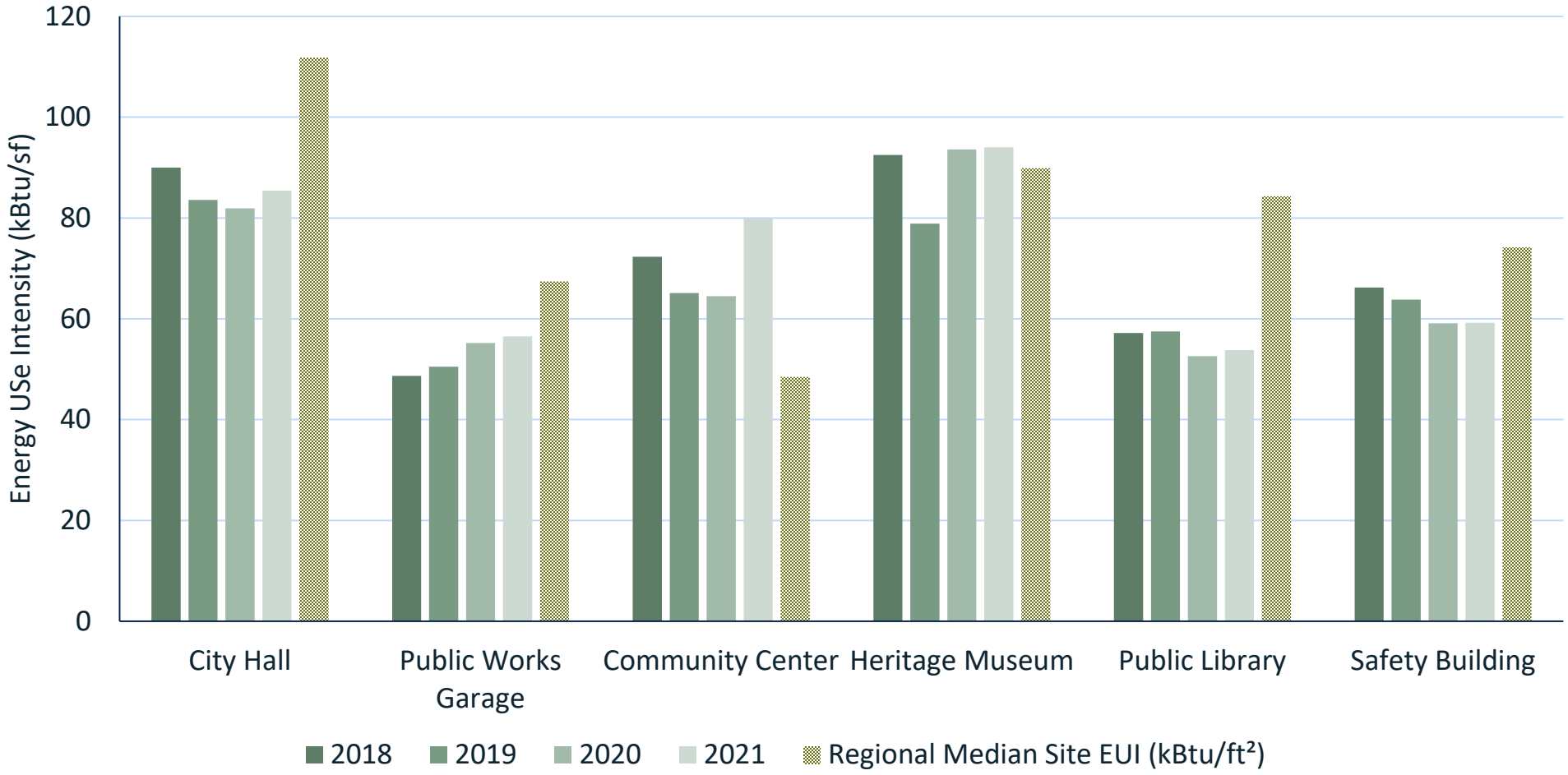



## Carbon Dioxide



# Building Energy Efficiency Opportunities

# Baseline Energy Use Intensity



# Building Recommendations

**Implement recommended measures for audited buildings.**

| | CITY HALL | LIBRARY | SAFETY BUILDING |
|---|---|---|---|
| **PRIORITY** | Steam trap review/study<br>Steam pipe insulation | Maintenance refresh<br>Low flow plumbing fixtures | Maintenance refresh<br>Limit electric space heaters<br>Low flow plumbing fixtures<br>Retro-commissioning |
| **AT REPLACEMENT** | Upgrade steam boiler system. | Upgrade building insulation<br>Perform air sealing<br>Upgrade windows<br>Upgrade HVAC units<br>Add ENERGY STAR appliances | Upgrade windows<br>Upgrade HVAC units<br>Add ENERGY STAR appliances |

# Building Energy Potential Savings

| | Upfront Cost ($) | Annual Energy Cost Savings ($) | Percent Cost Savings | Annual $CO_2$ Savings (metric tons) | Percent $CO_2$ Savings | Average Payback |
|---|---|---|---|---|---|---|
| **Library** | **>$345,350** | **$5,600** | **17%** | **36.3** | **29%** | **-** |
| Priority Measures | $50 | $270 | 1% | 1.6 | 1% | <1 year |
| EOL Measures | >$345,300 | $5,330 | 16% | 34.7 | 28% | - |
| **Safety Building** | **$60,400** | **$3,300** | **16%** | **21.1** | **16%** | **-** |
| Priority Measures | $10,700 | $2,600 | 13% | 17.2 | 13% | 3 years |
| EOL Measures | $49,700 | $700 | 3% | 3.6 | 3% | - |
| **City Hall** | **>$556,400** | **$4,000-$6,100** | **18%-28%** | **45.3 – 65.0** | **34% - 49%** | **-** |
| Priority Measures | $6,400 | $4,000 | 18% | 29.6 | 22% | 2 years |
| EOL Measures | >$550,000 | $0-$2,100 | 0%-10% | 15.8 - 35.5 | 12% - 27% | - |

# Solar Opportunities

# Solar Recommendations

**Install 100-150 kW of solar at city buildings to generate 15% to 20% of the City's electricity use.**

| Building | Size (kW dC) | Site Renewable Electricity | Payback (Years) | Annual $CO_2$ Savings (metric tons) | Annual Energy Cost Savings |
|---|---|---|---|---|---|
| **City Hall** | 26 | 42% | 12.6 - 14.4 | 20 | $2,906 - $3,316 |
| **Library** | 45 | 38% | 13 - 14.9 | 41 | $2,894 - $3,302 |
| **Public Works** | 43 | 45% | 14.5 - 16.6 | 39 | $3,524 - $4,021 |
| **Safety Building** | 26 | 22% | 15.8 - 18 | 19 | $4,222 - $4,817 |

| Buildings | Total Upfront Cost* | Focus on Energy Incentives* | IRA Tax Credit* | Net Cost* |
|---|---|---|---|---|
| **City Hall** | $65,000 | $3,750 | $19,500 | $41,750 |
| **Library** | $112,500 | $6,125 | $33,750 | $72,625 |
| **Public Works Garage** | $108,539 | $5,927 | $32,562 | $70,050 |
| **Safety Building** | $65,000 | $3,750 | $19,500 | $41,750 |

***All cost, incentive, and tax credit amounts are estimates**

# Fleet Opportunities

# Fleet Recommendations

**Pilot 2-3 electric vehicles in the municipal fleet.**

- Replace 2-3 vehicles with EVs
  - 2008 Chevrolet Impala (large car)
  - 2003 Chevrolet Silverado 1500,
  - 2016 Ford Explorer
- Install charging equipment
  - Safety Building and DPW Garage
  - Min. 2 level 2 charging ports at each location
- Train drivers and maintenance staff

| Category | Current Vehicle | New gasoline vehicle benchmark | Ex. EV Alternative | EV Incremental Cost | Cost Savings/Mile | Miles for Financial Payback |
|---|---|---|---|---|---|---|
| **Large Sedan** | Chevrolet Impala | 31 mpg $30,933 | Ford Mach-E | $4,600 | $0.088 | 52,000 |
| **Large SUV** | Chevrolet Tahoe | 17 mpg $54,200 | Mazda CX-90 PHEV | $0 | $0.143 | 0 |
| **Police Patrol** | Ford Explorer | 20 mpg $41,800 | Ford Lightning Pro SSV | $10,700 | $0.123 | 87,000 (~5.5 years) |
| **Full-size Pickup** | Chevrolet Silverado 1500 | 20 mpg $41,800 | Ford F150 Lightning | $8,500 | $0.123 | 70,000 (~17.7 years) |

# Fleet Recommendations

## Transition to EVs for light duty City vehicles

### Annual Savings Potential

| Vehicle category | Operating Cost Savings | $CO_2$ Emissions Savings |
|---|---|---|
| Large Car | $1,465 | 1.7 |
| Large SUV | $825 | 1.0 |
| Police | $14,755 | 16.9 |
| Full Size Pickup | $1,940 | 2.2 |
| Total | $18,985 | 21.8 |

**Use estimated total cost of vehicle ownership to guide purchasing**

Analysis should incorporate the following components:

- Upfront cost differential
- Ongoing fuel costs
- Maintenance costs
- Forecasted resale values

# Funding Opportunities

# Funding Available

- Focus on Energy and local utility rebates
- Inflation Reduction Act tax credits on vehicle purchases and renewable energy installations
- State and federal grant programs

# Questions?

**Dan Streit**
Slipstream
dstreit@slipstreaminc.org

**Maddie Koolbeck**
Slipstream
mkoolbeck@slipstreaminc.org

CITY OF WAUPUN DEPARTMENT OF PUBLIC WORKS
Waupun City Hall – 201 E. Main Street, Waupun WI
P: 920-324-7918  F: 920-324-7939
www.cityofwaupun.org

# City of Waupun Energy Plan

OCTOBER 1, 2023

City of Waupun

# Contents

# Executive Summary

For more than a decade, the City of Waupun has been committed to lowering its energy use and carbon impact. In 2009, the City signed a resolution for a 25% reduction in energy use by 2025. In 2018, the City reconfirmed its commitment with a resolution to reduce energy use in municipal operations by 5% in five years, and then quickly met that goal by upgrading lighting across city buildings.

To build on its previous efforts and identify additional potential energy cost savings, the City was awarded a planning grant from the State Office of Energy Innovation (OEI) at the Public Service Commission in 2022. Over the past year, the City of Waupun worked with Slipstream and Waupun Utilities, to develop a municipal energy plan that identified near-term cost-effective energy saving opportunities.

The project process included:

- Collection of energy use and cost data from buildings and fleet
- Compilation of energy data to develop energy and emissions baselines
- Energy assessment walkthroughs at three city facilities
- Analysis of energy data, along with building and vehicle information to identify cost-savings opportunities for renewable energy, fleet conversions, and building energy efficiency

Creating an inventory of current energy use, costs, and carbon by source is a vital first step in a planning process. The energy profile allows for identification of savings opportunities and serves as a baseline to use when tracking future progress. The team started by inventorying the number of buildings and fleet vehicles, and associated energy use and costs.

The City of Waupun has seven municipal buildings, or roughly 150,000 square feet of buildings, and an eighth building in the design and construction process. The City also owns 35 fleet vehicles, including police vehicles, dump trucks, pickup trucks, lawnmowers and passenger SUVs or cars. The annual energy use of these buildings and vehicles produces roughly 1,138 metric tons of carbon dioxide ($CO_2$) and costs roughly $227,635. Table 2 provides the breakdown of costs and carbon across each existing building and for fleet.

*Table 1. Annual emissions and costs by source (2021 data)*

| Source | $CO_2$ Emissions (metric tons) | Percent of Total Carbon | Cost |
|---|---|---|---|
| **Waupun Aquatic Center** | 107 | 9% | $16,955 |
| **Waupun City Hall** | 113 | 10% | $17,900 |
| **Waupun Community Center** | 304 | 27% | $48,095 |
| **Waupun Heritage Museum** | 26 | 2% | $4,160 |
| **Waupun Public Library** | 140 | 12% | $22,235 |
| **Waupun Public Works Garage** | 133 | 12% | $21,135 |
| **Waupun Safety Building** | 127 | 11% | $20,155 |
| **Fleet** | 183 | 16% | $77,000 |
| **Total** | 1,138 | - | $227,635 |

Using the baseline, the team identified recommendations for fleet conversions, solar installations, and energy efficiency improvements for municipal buildings. In addition to recommendations on direct upgrades, the plan also includes recommendations on internal guidelines or policies that can help institutionalize progress to ensure savings continue.

Figure 1 provides the overview of the recommendations by category. The recommendations serve as initial items for consideration to save energy and reduce the carbon impact of the city. Funding is available through local utility rebates, federal funding, and state funding to implement these recommendations. More detail is in the report on funding options for the recommendations.

*Figure 1. City of Waupun Recommended Energy Actions*

**Energy Efficiency**

Continue **ongoing benchmarking** of building performance.

Implement **recommended measures** for audited buildings.

Adopt standard **operating procedures** across buildings.

Institute standard **purchasing policies** for building equipment across all buildings.

**Solar**

Install **100-150 kW of solar** at city buildings offsetting 15 to 20% of electricity use.

Require all new construction for city buildings to **be solar-ready**.

Consider **battery installations** at time of generator replacement.

**Fleet**

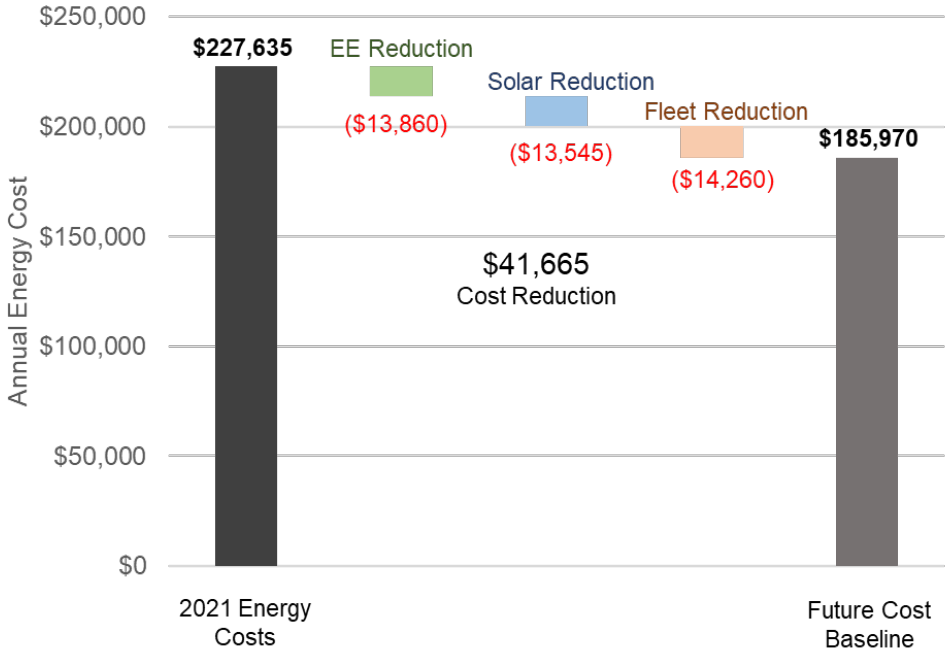
Pilot **two to three electric vehicles** in the municipal fleet.

Use the **estimated total cost** of vehicle ownership to guide vehicle purchasing decisions.

Consider how the city can advance municipal and public **EV charging.**

Figure 2 illustrates the potential cost reduction from implementing the recommended measures from this plan. Energy efficiency leads to $13,860 savings, solar installations lead to $13,545 savings, and fleet conversions to EVs lead to $14,260 savings. This amounts to a 18% reduction in cost, or roughly $41,000 savings.

*Figure 2. Potential cost reduction from recommended actions*



# Glossary

**Battery energy storage system (BESS):** Equipment that is able to store energy and then release it when needed for use. These are often lithium-ion batteries.

**Direct pay:** A provision in the Inflation Reduction Act that makes non-taxable entities eligible for tax credits for clean energy items (including renewable energy and alternative vehicles)

**Energy walkthrough:** Assesses how a building currently uses energy and identifies opportunities to reduce the building's energy consumption.

**Electric vehicle (EV):** vehicles; cars, trucks, and buses powered by a battery and electricity

**Focus on Energy:** Wisconsin's statewide program to increase energy efficiency and renewable energy use among residents, businesses, and local governments.

**Heat pump:** Single heat pump replaces both furnace and an air conditioner; fueled only by electricity and very efficient

**Internal combustion engine (ICE):** Conventional gasoline or diesel vehicles

**Inflation Reduction Act (IRA):** Federal law passed in 2022 that directs significant funding to clean energy and climate solutions. A portion of funding is directed at local governments through rebates or grant programs.

**Microgrid:** A group of interconnected loads and energy resources that can connect and disconnect from the grid. Can operate as part of larger group or on its own.

**Net metering:** Billing mechanism that credits solar energy owners for electricity added to grid

**Non-taxable entity:** An entity that is not required to pay income taxes. Includes nonprofits, local and state governments.

**PV:** Photovoltaic solar energy; converts energy from the sun to electricity

**Renewable energy:** Energy that is generated from a naturally replenishing resource that does not release carbon, such as solar energy, wind energy, or geothermal.

**Total cost of ownership (TCO):** Total cost of owning equipment, including upfront cost, any energy or maintenance costs, and resale forecast

# Introduction

For more than a decade, the City of Waupun has been committed to lowering its energy use and carbon impact. In 2009, the City signed a resolution for a 25% reduction in energy use by 2025. In 2018, the City reconfirmed its commitment with a resolution to reduce energy use in municipal operations by 5% in five years, and then quickly met that goal by upgrading lighting across city buildings.

In 2021, the City identified the benefit of developing an energy plan that would identify and prioritize energy-saving measures for municipal operation. The City applied for and was awarded a planning grant from the State Office of Energy Innovation (OEI) at the Public Service Commission to complete this work.

Over the past year, the City of Waupun worked with Slipstream and Waupun Utilities to compile current energy, building, and fleet data. Slipstream, a nonprofit, served as the technical energy advisor to the City. The project process included collection of energy use from buildings and fleet, compilation of energy data to develop an energy baseline, energy walkthroughs at three city facilities, and analysis of energy data to identify cost-savings opportunities for renewable energy, fleet conversions, and building energy efficiency.

This document details the City's energy plan. It starts with a summary of the baseline energy profile for City of Waupun buildings and fleet. It then provides recommendations for building efficiency upgrades, solar installations on city facilities, and fleet upgrades to electric vehicles.

*Figure 3. Overview of planning process*

**Data Collection**

- Electricity and natural gas data for buildings
- Gasoline and diesel data
- Building equipment lists
- Previous actions and goals of energy planning

**Data Compilation and Building Walkthroughs**

- Development of energy use, cost, and carbon baseline for city operations
- Walkthrough energy audits of city buildings to review equipment

**Analysis of energy saving opportunities**

- Analysis of city data to identify cost saving opportunities:
  - Solar installation
  - Fleet conversion
  - Building energy efficiency
  - Internal policies to drive reductions

# Baseline Data

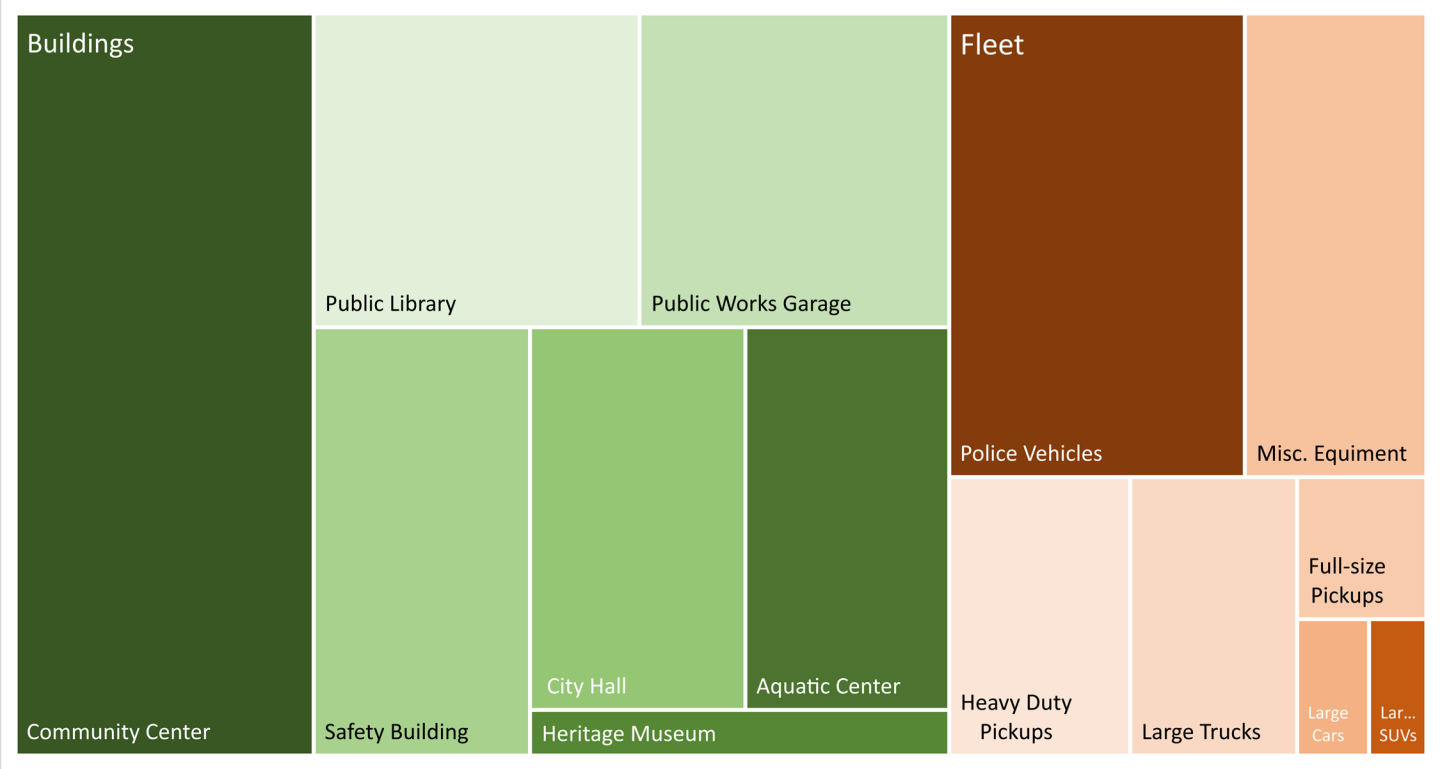
The City of Waupun has seven municipal buildings or roughly 150,000 square feet of buildings, and an eighth building in the design and construction process. The City also owns 35 fleet vehicles – including police vehicles, dump trucks, pickup trucks, lawnmowers and passenger SUVs or cars. The City currently has no renewable energy installations and only owns internal combustion (ICE) vehicles. The energy use of these buildings and vehicles amounts to roughly 1,138 metric tons of carbon dioxide ($CO_2$) emitted a year and roughly $227,635 a year. Table 2 provides the breakdown of costs and carbon across each existing building and for fleet.

*Table 2. Annual emissions and costs by source (2021 data)*

| Source | $CO_2$ Emissions (metric tons) | Percent of Total Carbon | Cost |
|---|---|---|---|
| **Waupun Aquatic Center** | 107 | 9% | $16,955 |
| **Waupun City Hall** | 113 | 10% | $17,900 |
| **Waupun Community Center** | 304 | 27% | $48,095 |
| **Waupun Heritage Museum** | 26 | 2% | $4,160 |
| **Waupun Public Library** | 140 | 12% | $22,235 |
| **Waupun Public Works Garage** | 133 | 12% | $21,135 |
| **Waupun Safety Building** | 127 | 11% | $20,155 |
| **Fleet** | 183 | 16% | $77,000 |
| **Total** | 1,138 | - | $227,635 |

The total cost for energy purchases varies across buildings and fleet based on hours of occupancy, efficiency of the building or vehicle stock, cost of the energy, and size of the building or number of vehicles in a category. Figure 4 illustrates the relative cost impact across the two main categories of energy use (buildings in green and fleet in orange). The Community Center/Hockey Rink has the largest energy cost contribution for buildings and police vehicles have the largest contribution across all fleet.

*Figure 4. Annual energy cost impacts of City buildings and fleet*



# Recommendation Overview

Slipstream analyzed potential opportunities to lower energy use, reduce carbon emissions, and save money across fleet conversions, solar installations, and energy efficiency improvements in city buildings. For each of these areas, the team identified recommendations for near-term installations or upgrades and recommendations for ongoing internal policies for purchasing, new construction, and operations. The recommendations focus on both near-term upgrade opportunities and ways to institutionalize progress to ensure savings continue into the future.

The recommendations are split into three primary categories – energy efficiency upgrades, solar upgrades, and fleet upgrades or conversions. We recommend the City prioritize a few upgrades each year starting with the following:

- Install priority energy efficiency measures for buildings over the next two years.
- Install solar at one or two buildings in the next couple of years. Prioritize a building where demonstration to public is also possible (Waupun Library or City Hall).
- Purchase electric vehicles for two to three large passenger vehicles in the next two years.
- Begin to develop and institute standard operating and purchasing guidelines to help institutionalize the plan and City's commitment to these efforts.

Figure 5 provides the overview of the recommendations by category. The following sections of the report provide into more detail on each of the recommendations. Funding opportunities for each of the recommendations are also presented in detail.

*Figure 5. City of Waupun Recommended Energy Actions*

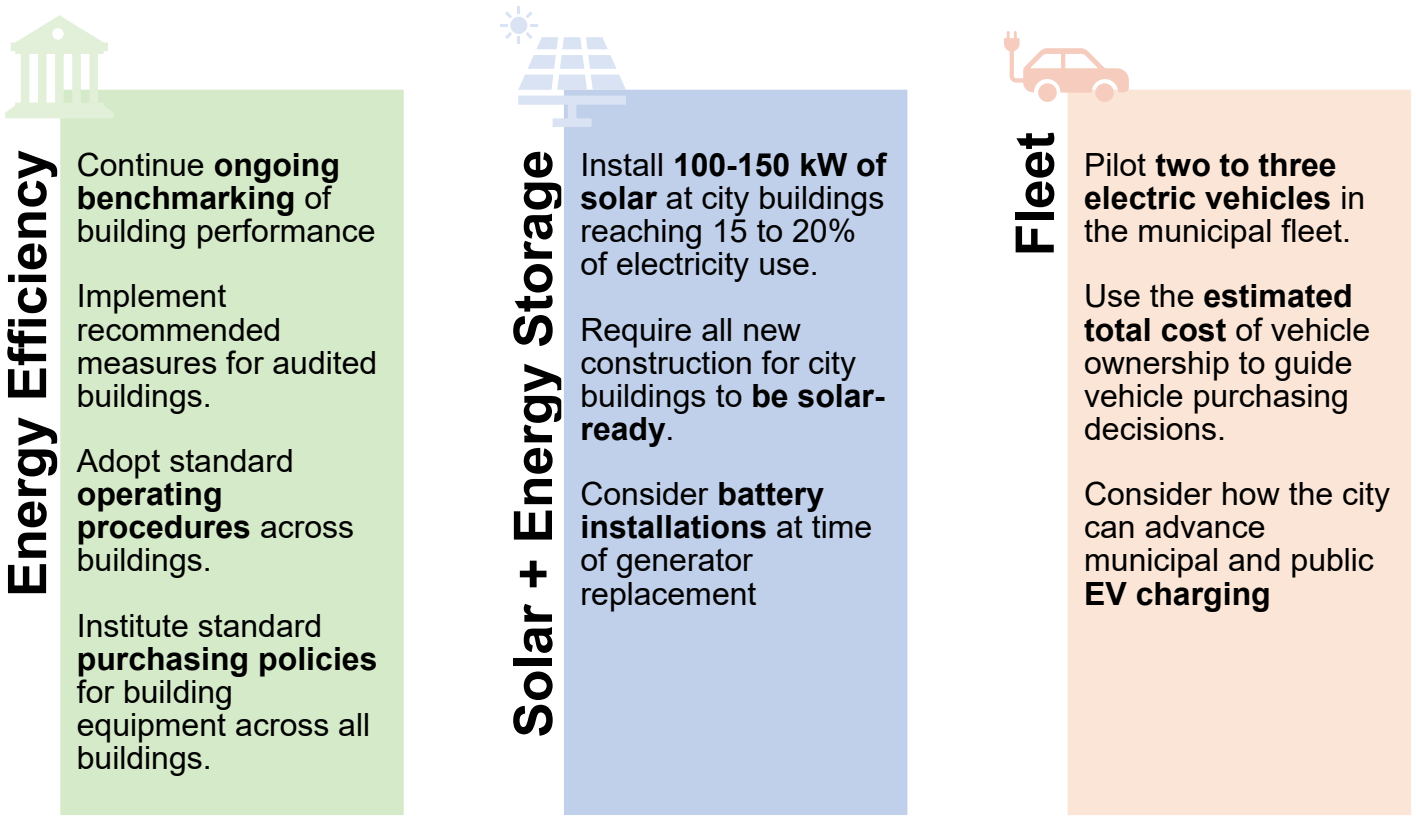


Figure 6 illustrates the potential cost reduction from implementing the recommended measures from this plan. Energy efficiency leads to $13,860 savings, solar installations lead to $13,545 savings, and fleet conversions to EV's lead to $14,260 savings. This amounts to a 18% reduction in cost, or roughly $41,000 savings. The energy efficiency reduction includes all savings from recommended end-of-life equipment replacements, fleet reduction includes savings from transitioning all vehicles with eligible alternatives to EVs, and solar reduction includes installation of all recommended arrays.

*Figure 6. Potential cost reduction from recommended actions*

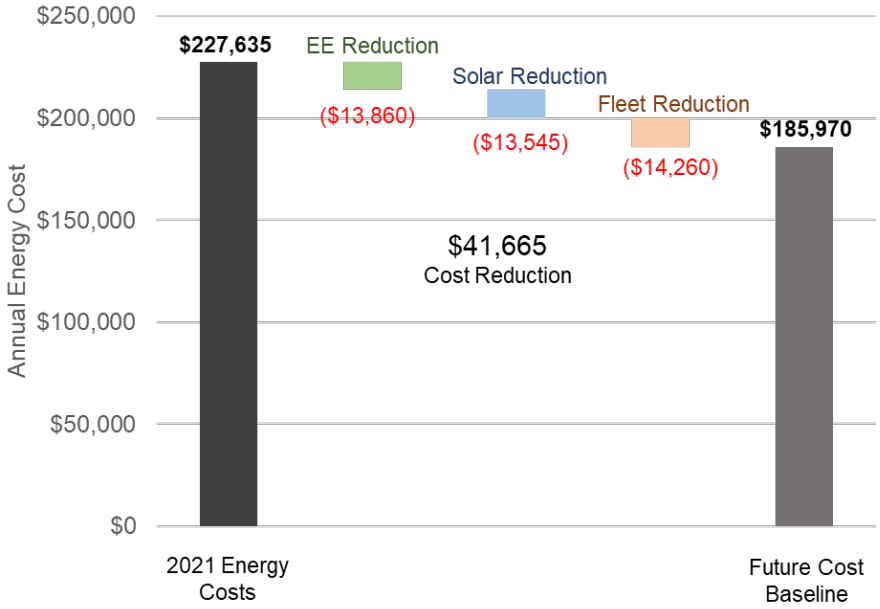
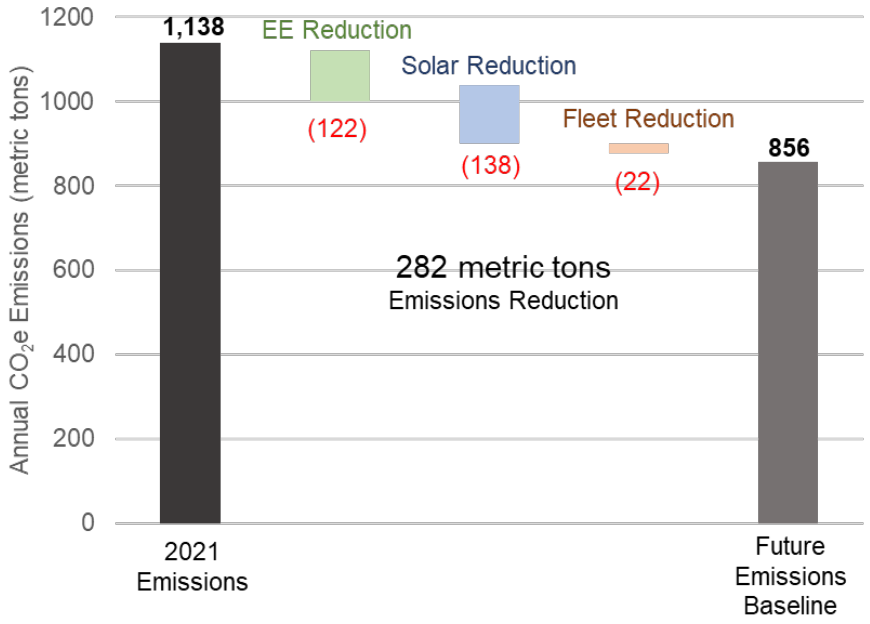



Figure 7 illustrates the potential $CO_2$ reduction from implementing the recommended measures from this plan. Energy efficiency installations leads to 122 metric tons of savings, solar installations lead to 138 metric tons of savings, and fleet conversions leads to 22 metric tons of savings. This amounts to a 25% reduction in carbon, or 282 metric tons of savings. As Waupun Utilities continues to transition to renewable energy and more vehicles and building equipment transitions to electricity, further reductions in $CO_2$ emissions will be possible.

*Figure 7. Potential $CO_2$ reduction from recommended actions*



# Energy Efficiency Recommendations

**Recommendations**

Continue benchmarking building energy performance.

Implement recommended measures for buildings to achieve near-term savings.

Adopt standard operating procedures across buildings.

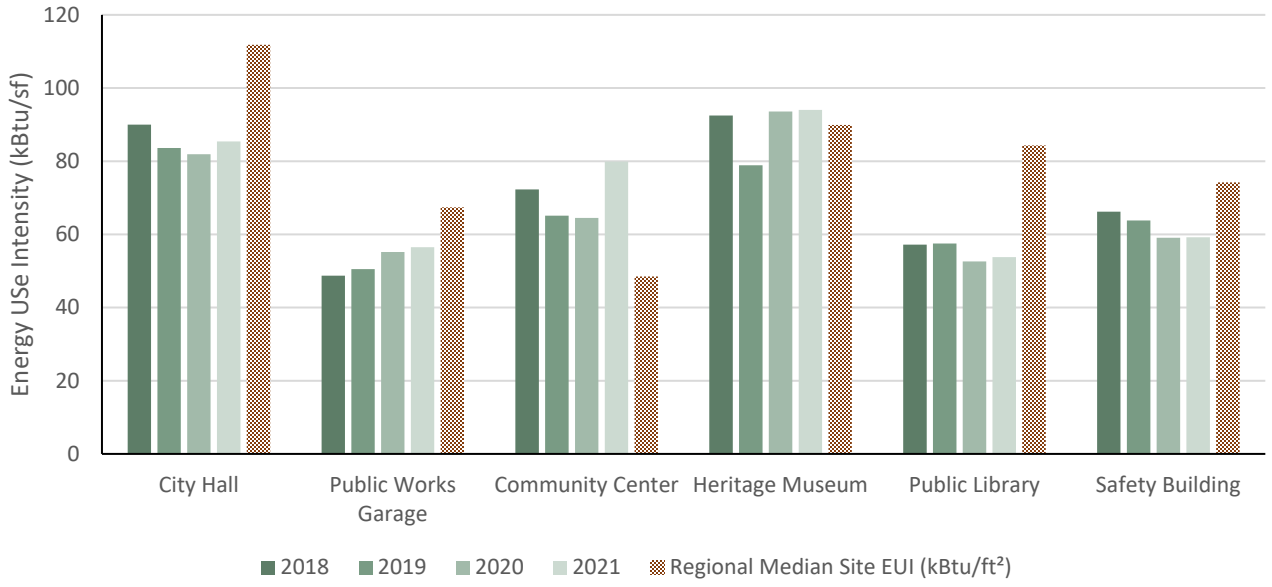
Institute standard purchasing policies for building equipment across all buildings.

## Recommendation 1: Continue ongoing benchmarking of building performance

The energy performance of buildings can be tracked by examining energy use intensity over time or in comparison to other buildings, through a process called benchmarking. Energy use intensity (EUI) is a metric that shows the building's total energy use divided by square feet of the building and provides a standard approach to examine the energy performance of a building.

Figure 8 illustrates the energy use intensity of all Waupun city buildings over time and compared to the median energy use intensity of similar buildings in the climate zone. The Aquatic Center is not included in the graph as it is difficult to normalize a pool's energy use using square feet data. In general, the buildings all perform well compared to the median energy use intensity for similar types of buildings and are relatively consistent over time. The Community Center performs slightly worse than the median EUI – which likely reflects its joint operation as a hockey rink and the high electricity use from the rink. For the other buildings, the strong performance of the EUIs reflects the recent efforts by Waupun to lower energy use across buildings but does not suggest that there are not further opportunities to lower energy use and save money.

*Figure 8. Energy use intensity of city facilities compared to median energy use intensity of similar buildings in same climate zone*




Continuing to benchmark the City's buildings over time is a key mechanism to address unexpected changes in energy use, identify maintenance needs, and measure progress toward energy saving goals. EnergyStar Portfolio Manager is a free tool that provides a centralized location for data collection and the ability to benchmark against a national sample of similar building types. The City of Waupun started adding data to the website during this project timeline and the project team recommends that the City continue adding data at least annually to the tool.

## Recommendation 2: Implement recommended measures for walkthrough buildings

The project team performed energy walkthroughs at two buildings, the Safety Building and the Library. The team also examined City Hall's heating system. Slipstream then developed energy models to provide a representative assessment and estimate savings opportunities. The models were informed by onsite review of equipment, the condition of the facilities, code requirements at time of construction, and typical meteorological year weather data.

Measure costs were based on past project experience, secondary research, and industry reference materials. These estimates intend to inform prioritizing improvement measures. Actual energy savings from the recommended improvements will be highly dependent on the weather and actual building operation costs. Further engineering and final pricing of all recommended measures will be required prior to implementation.

New LED lighting was installed in all City buildings in 2019. Based on our walkthrough of the buildings, building systems seem well maintained, although some equipment is near end-of-life and should be replaced.

Table 3 illustrates the recommended measures across the three audited buildings. The measures are organized by high priority vs end-of life (EOL) priority. The high priority measures are items with short payback periods or significant savings. End-of-life are upgrade recommendations for when equipment reaches replacement age. A maintenance refresh is installation of low to no-cost items like new filters, air sealing around windows or doors, or installing weatherstripping.

*Table 3. Overview of recommended measures*

| | CITY HALL | LIBRARY | SAFETY BUILDING |
|---|---|---|---|
| **PRIORITY** | Steam trap review/study<br>Steam pipe insulation | Maintenance refresh<br>Low flow plumbing fixtures | Maintenance refresh<br>Limit electric space heaters<br>Low flow plumbing fixtures<br>Retro-commissioning |
| **END OF LIFE** | Upgrade steam boiler system. | Upgrade building insulation<br>Air sealing<br>Upgrade windows<br>Upgrade HVAC units<br>ENERGY STAR appliances | Upgrade windows<br>Upgrade HVAC units<br>ENERGY STAR appliances |

Table 4 details the upfront cost, annual cost savings, payback period, and annual $CO_2$ savings. The upfront cost is estimated and does not include incentives. It is recommended that the City discuss potential incentives with their Focus on Energy representative. Payback period is calculated as total upfront cost divided by annual cost savings. The end-of-life measures payback period is not included as it depends on incremental cost compared to the other option being considered at replacement time.

The library's high cost is reflective of a higher window replacement cost and added cost for wall insulation, both at EOL. The high cost for City Hall reflects the complexity of the steam boiler replacement. It is an estimated cost, and the historic characteristics of the existing system may increase these costs significantly. Appendix 1: Individual Building Results has a full description for each walkthrough building.

*Table 4. Cost and carbon savings from recommended measures*

| | Upfront Cost ($) | Annual Energy Cost Savings ($) | Percent Cost Savings | Annual $CO_2$ Savings (tons) | Percent $CO_2$ Savings | Average Payback |
|---|---|---|---|---|---|---|
| Library | >$345,350 | $5,600 | 17% | 36.3 | 29% | - |
| Priority Measures | $50 | $270 | 1% | 1.6 | 1% | <1 year |
| EOL Measures | >$345,300 | $5,330 | 16% | 34.7 | 28% | - |
| Safety Building | $60,400 | $3,300 | 16% | 21.1 | 16% | - |
| Priority Measures | $10,700 | $2,600 | 13% | 17.2 | 13% | 3 years |
| EOL Measures | $49,700 | $700 | 3% | 3.6 | 3% | - |
| City Hall | >$556,400 | $4,000-$6,100 | 18%-28% | 45.3 – 65.0 | 34% - 49% | - |
| Priority Measures | $6,400 | $4,000 | 18% | 29.6 | 22% | 2 |
| EOL Measures | >$550,000 | $0-$2,100 | 0%-10% | 15.8 - 35.5 | 12% - 27% | - |

## Recommendation 3: Institute a standard operating policy at all buildings

The operation of a building and the behavior of building occupants, has a significant impact on building energy use. Operational policies can have impacts beyond energy use, most notably the potential to impact occupant comfort and productivity. We recommend that City of Waupun develop policies that define clear rules and standards for the operation of municipal buildings.

These types of policies are a way to potentially save energy without spending money on new equipment or controls. However, they need to find the right balance between energy performance and occupant comfort and safety. To that end, we recommend that along with operational policies, the City of Waupun set up the appropriate communications channels so that building occupants can provide ongoing feedback.

Figure 9 provides a full list of items to consider for an operating policy. In the walkthroughs at the City of Waupun, we identified a few areas where standard operating procedures could lead to potential savings. One item to highlight is establishing setpoints and setbacks for occupied and unoccupied times. Some buildings already follow this practice but instituting across buildings could lead to additional savings and ensure that the policy continues to be followed through potential staff changes.

Another recommendation is to consider how many individual pieces of equipment are in offices and consider if there are ways to consolidate or eliminate some pieces of equipment. For example, as improvements in heating comfort at buildings are made, the removal of space heaters can reduce electricity use in the winter.

*Figure 9. Operating policy examples*

| | | |
|---|---|---|
| Operational Policies | Maintenance | Follow regular maintenance schedule for buildings and equipment. |
| | | Change air filters on regular basis. |
| | | Ensure air-conditioning units maintain refrigerant charge. |
| | Heating, ventilation, and air conditioning (HVAC) systems | Establish temperature setpoints and setbacks for occupied and unoccupied times. |
| | | Keep a list of operating parameters, including the temperature set points and operating schedule for each piece of equipment. Keep the list in a visible location to make sure equipment is programmed correctly. |
| | | Post guidance on when operable windows can be opened based on room thermostat setpoints. For example, assuming thermostats are set from 70 degrees to 75 degrees, building occupants should have clear direction that they can opened windows between 68-77 degrees outdoor temperature. |
| | | Create communication channels for building occupants to provide feedback on comfort or operational issues. A regularly administered survey can be useful to gather additional feedback on occupant comfort. |
| | Plug loads | Develop a policy that prohibits or limits the use of individual fridges, space heaters, printers, and other peripheral equipment at workstations. Consider ways to consolidate the number of fridges and printers across the building. |
| | | Implement computer power management on staff computers using a 30 minute or less delay before putting computers to sleep. |
| | | Implement TV sleep requirements to ensure TVs are not running all day. |
| | Lighting | Promote or incentivize occupants to turn off switched lights when not in use. |

## Recommendation 4: Institute a standard purchasing policy for future upgrades at all buildings

There are opportunities to increase building efficiency with any new piece of equipment that uses energy. In limited cases, it may make sense to upgrade equipment early; but more importantly, the decision at replacement is important and impacts energy use for decades. We recommend that purchasing policies be put in place such that all municipal employees that are responsible for purchasing such equipment have a clear guideline as to what is an acceptable purchase to meet the municipal energy goals.

Figure 10 summarizes the purchasing recommendations.

*Figure 10. Purchasing policy example items*

| | | |
|---|---|---|
| Purchasing Policies | Heating, ventilation, and air conditioning (HVAC) systems | Consider installation of air source or dual-fuel heat pumps to replace HVAC systems. |
| | | Install a minimum of condensing furnaces and boilers with efficiency higher than 95%. |
| | | Install a minimum of ENERGYSTAR certified AC with SEER2 ≥15.2. Refer to CEE Tiers for energy efficient equipment for larger cooling equipment like RTUs. |
| | | Install smart thermostats with occupancy sensors to setback temperatures. |
| | | Consider installing or upgrading the building automation system when replace major equipment. |
| | Appliances and other equipment | Purchase ENERGY STAR equipment to replace office equipment and water heaters. |
| | | New windows should meet or exceed ENERGY STAR requirements. Large commercial windows or store front windows should target U-value of 0.3 and SHGC of 0.25. |
| | | Consider replacing water heaters with hybrid electric water heaters. |
| | Lighting | Consider addition of daylighting and occupancy controls for LED systems. |

## Electrification Considerations

Electrification is the process of phasing out equipment that uses fossil fuels (i.e., natural gas, propane, gasoline, and diesel fuel) with equipment that uses electricity. For Waupun, this is appliable to heating systems and water heating systems in most buildings. The main benefit of electrification is a reduction in $CO_2$ emissions compared to fossil-fuel equipment. $CO_2$ emissions from electric equipment will continue to drop as the electric grid becomes cleaner while gas equipment will maintain a constant emissions rate throughout time.

Historically, heat pumps have been more expensive than high-efficiency natural gas systems. However, state and federal incentives and changing energy costs are causing heat pumps to become more cost competitive. As the costs on heat pumps continue to drop, the City should consider heat pumps as an option for future HVAC and water heating upgrades. The City should review the incentives available, the resulting overall cost and $CO_2$ differential between heat pumps and natural gas systems when replacing existing equipment. Table 5 lists the heat pump options for existing systems across Waupun buildings. It's recommended to start with furnace split-systems and potentially the City Hall boiler.

*Table 5. Heat pump system options for existing systems in Waupun buildings*

| Existing System | Heat Pump System | Notes |
|---|---|---|
| **Furnace and A/C Split System** | Dual-Fuel Air-Source Heat Pump | A cost-effective electrification option that still uses gas but electrifies heating at temperatures above 25°F. |
| | Air-Source Heat Pump | Full electrification option. |
| **Steam Boiler System** | Air-Source Variable Refrigerant Flow (VRF) | Suitable for historic retrofit applications. |
| | Geothermal heat pump system | Requires land for geothermal bore field. Inflation Reduction Act offsets 30% to 50% of the cost. |
| **Single Zone RTU** | Heat-Pump RTU | Emerging technology. |

**Recommendations**

Install 100-150 kW of solar at city buildings to generate 15 to 20% of the City's electricity use.

Require all new construction for city buildings to be solar-ready.

Consider battery installations at time of generator replacement.

## Recommendation 1: Install 100 – 150 kW of solar at city buildings

Solar energy installations are a cost-effective way to reduce carbon emissions and generate cost savings for the City. The analysis examined all City buildings for solar installations and identified four buildings that were good candidates for solar installations. The analysis incorporated available space at each building, hourly historical data for the building, and the current utility rates.

Table 6 provides the solar array capacity recommendations, percent renewable electricity for each site that the system would generate, and a simple payback period. The solar array size is determined by examining available roof space, hourly energy use of the building, and cost effectiveness. The payback period is calculated by dividing yearly utility bill savings by the net upfront cost. The annual cost savings represent utility bill savings. Both the energy cost savings and payback period are demonstrated as a range – the low value assumes current electric rates and high value applies a 1% increase yearly. The $CO_2$ savings represent annual emissions avoided.

*Table 6.Solar PV installation recommendations for Waupun city buildings*

| Building | Size (kW dC) | Percent Renewable Electricity | Payback (Years) | Annual $CO_2$ Savings (metric tons) | Annual Energy Cost Savings |
|---|---|---|---|---|---|
| **City Hall** | 26 | 42% | 12.6 - 14.4 | 20 | $2,906 - $3,316 |
| **Library** | 45 | 38% | 13 - 14.9 | 41 | $2,894 - $3,302 |
| **Public Works** | 43 | 45% | 14.5 - 16.6 | 39 | $3,524 - $4,021 |
| **Safety Building** | 26 | 22% | 15.8 - 18 | 19 | $4,222 - $4,817 |

The costs for each of the solar installations are in Table 7. The estimated upfront cost is $2,500 per kW for solar installations but it should be noted that only final bids can give actual costs for each installation. The Focus on Energy incentives represent local utility incentives available for installations of solar and is based on the size (generating capacity) of the solar array. Cities are eligible for the Inflation Reduction Act tax credits through elective pay, a provision that allows non-taxable entities to receive clean energy tax credits (see Funding Opportunities for Recommendations). The credit is 30% of the total upfront cost. Net cost represents total cost after the state incentives and tax credit is applied.

*Table 7. Cost details of solar PV installations for Waupun city buildings*

| Buildings | Total Upfront Cost | Focus on Energy Incentives | IRA Tax Credit | Net Cost |
|---|---|---|---|---|
| **City Hall** | $65,000 | $3,750 | $19,500 | $41,750 |
| **Library** | $112,500 | $6,125 | $33,750 | $72,625 |
| **Public Works Garage** | $108,539 | $5,927 | $32,562 | $70,050 |
| **Safety Building** | $65,000 | $3,750 | $19,500 | $41,750 |

The full recommendations for each building, including placement of solar panels and input details are included in Appendix 2: Solar Methodology and Details.

## Recommendation 2: Require all new construction for city buildings to be solar-ready.

Design characteristics of buildings – such as orientation, available roof space, and roof type – greatly impact the feasibility of future solar installations on a building. A solar-ready building is designed to minimize costs and optimize production of a future solar installation. The added design requirements often add minimal, if any, construction costs for a new building. The main design recommendations are listed below and can be integrated into design requirements for the construction or design firms[1]:

1. Avoid shading over portions of the roof with potential southern exposure during peak sunlight hours, if possible
2. Minimize and/or cluster equipment on rooftop to ensure space is available for solar panels
3. Prioritize making roof space available for south-facing portion of roof
4. Consider roof type to ensure it can carry extra load from solar panels
5. Determine mounting strategy and feasibility
6. Place electrical panel near future PV location and keep breaker free for PV circuit
7. Consider running electrical conduit from electrical panel to future PV location
8. Plan locations for inverter components

[1] L. Lisell. 2009. “Solar Ready Buildings Planning Guide.” https://www.nrel.gov/docs/fy10osti/46078.pdf

## Recommendation 3: Consider battery energy storage systems at generator replacement.

Fossil fuel generators have been the most common solution for resiliency needs at a building because of their ability to run during power outages and relatively low upfront costs. However, generators alone often are restricted by code from running during normal operations. Instead, battery energy storage systems (BESS) paired with solar PV, operating as a microgrid, are increasingly used as the primary backup system because they provide benefits during normal operations and provide backup power during emergencies. The inclusion of solar PV with the battery allows for recharging of the battery during grid outages, and for additional energy cost savings during normal operations.

The U.S. Department of Energy (DOE) defines a microgrid as "a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that acts as a single controllable entity with respect to the grid. A microgrid can connect and disconnect from the grid to enable it to operate in both grid-connected or island-mode."[2]

The primary concern with BESS is cost. As costs continue to decline, BESS is becoming a viable option especially for new construction or at generator replacement. From 2010 to 2018, battery prices fell by 85%, and costs are predicted to continue to decline at a rate of 18%.[3] The U.S. National Renewable Energy Lab (NREL) estimates that a BESS costs $388 per kWh of energy and $775 per kW of capacity, compared to a diesel generator at $500 per kW of capacity.[4] For a BESS, the per kW and per kWh costs are additive– a one kW, one kWh battery would cost approximately $388 plus $775, or $1,063.

As costs continue to fall, microgrids are important to consider when replacing a generator or constructing a new building. Figure 11 includes a checklist for items to consider at time of generator replacement.

*Figure 11. Microgrid considerations checklist*

| | |
|---|---|
| **Consider batteries where backup power is needed** | At time of generator replacement or purchase, compare upfront equipment costs, ongoing operation and maintanance costs, the potential energy and demand cost savings, and performance requirements to determine best option. |
| **Utilize microgrid ready design during renovations and construction** | Similar to solar-ready, microgrid-ready design spreads out costs and ensures a building is ready for a battery in the future. Key considerations include physical space for a battery and making sure solar inverters are compatible if solar is installed first. |
| **Consider energy efficiency and demand management to decrease solar and storage capacity needs** | When sizing a BESS, the baseline load is the single most important factor. If there are ways to decrease total energy use through energy efficiency and demand management, this can allow for a smaller and less costly system. |
| **Consider length of outage system needs to cover** | The length of outage for the system to cover is a key input in determining backup system size. It's important to think through functions of the building and how those relate to number of hours a system should cover. |
| **When sizing DER components, determine the critical loads at the facility** | The amount of load that must be sustained during an outage is a key factor in the size of storage required. Stakeholders familiar with the building load and needs can estimate which functions should be considered critical load. |

[2] Ton and Smith, "The U.S. Department of Energy's Microgrid Initiative." https://www.energy.gov/sites/prod/files/2016/06/f32/The%20US%20Department%20of%20Energy%27s%20Microgrid%20Initiative.pdf
[3] Goldie-Scot, "A Behind the Scenes Take on Lithium-Ion Battery Prices." https://about.bnef.com/blog/behind-scenes-take-lithium-ion-battery-prices/
[4] S. Mishra et al., "The ReOpt Web Tool User Manual," 2021. https://reopt.nrel.gov/tool/reopt-user-manual.pdf

# Fleet Recommendations

**Recommendations**

Pilot 2-3 electric vehicles in the municipal fleet.

Use estimated total cost of vehicle ownership to guide purchasing.

Consider how the City can advance municipal and public EV charging.

## Recommendation 1: Pilot 2-3 Electric Vehicles in Municipal Fleet

The City of Waupun's current fleet includes 17 gasoline-powered vehicles and 15 diesel-fueled vehicles. Table 8 shows fuel use, miles driven, and miles per gallon in 2021 across seven vehicle categories. It excludes fuel use for off-road equipment. Police vehicles include small and mid-sized SUVs. These vehicles were grouped together to reflect the unique use patterns and shorter replacement schedules.

*Table 8. City of Waupun fleet vehicle baseline*

| Category | Number of Vehicles | Fuel Purchased (gallons) | Fuel cost | Emissions (metric tons $CO_2$) | Miles Driven | Avg MPG |
|---|---|---|---|---|---|---|
| **Large Sedan** | 2 | 597 | $2,135 | 5.1 | 15,750 | 26.4 |
| **Large SUV** | 1 | 475 | $1,699 | 4.0 | 5,795 | 12.2 |
| **Full-size Pickup** | 4 | 1,116 | $3,992 | 9.5 | 15,774 | 14.1 |
| **Heavy Duty Pickup** | 9 | 2,674 | $10,958 | 26.1 | 26,954 | 10.1 |
| **Police SUVs** | 8 | 8,330 | $29,798 | 71 | 120,107 | 37 |
| **Large Truck** | 7 | 2,361 | $10,102 | 24.1 | 13,753 | 5.8 |
| **Street Sweeper** | 1 | 1,114 | $4,766 | 11.4 | 3,316 | 3.0 |
| **Total** | **32** | **20,173** | **77,000** | **183** | **201,449** | **12.0** |

EVs offer several advantages compared to diesel or gasoline vehicles (see sidebar). EVs have similar performance capabilities as gasoline vehicles and the range of new EVs satisfies most city needs. Typical daily mileage for most City vehicles is less than 40 miles and most EVs can drive over 200 miles before they need to be recharged. Therefore, assuming that City vehicles rarely travel more than 200 miles per day, City vehicles may primarily be charged when off-duty. To identify alternatives to save money and reduce emissions compared to the existing vehicles, the project team focused on opportunities for Waupun to replace its existing cars and trucks with EVs.

**Benefits of EVs**

Lower fuel cost ($/mile) than gasoline or diesel vehicles.

Maintenance costs 50% lower compared to gasoline or diesel vehicles.

Reduce $CO_2$ emissions 40% - 55% with current electricity mix.

Lower energy use while idiing reduces engine wear and saves money

To ease into the transition to EVs and address potential concerns about driving and maintaining an EV fleet, the project team recommends that the City of Waupun start by replacing 2-3 existing vehicles ready for replacement with EV alternatives. This pilot approach would include three components:

1. Replace a limited number of vehicles in the City's existing fleet with EV alternatives.
2. Install EV charging stations to fuel the vehicles in the pilot
3. Train staff to drive and maintain EVs, as applicable.

During the 12–18-month pilot period, the City will track the cost and amount of electricity used to charge the EVs, the maintenance requirements, and any feedback from drivers on their experiences driving the cars. The City can use this information to guide how it adds more EVs into its municipal fleet in the future.

## Pilot Component 1: Replace existing fleet vehicles with EVs

The first component of the pilot is to replace 2 to 3 existing vehicles with EV options when the current vehicles reach replacement age. The project team analyzed fleet data to identify which vehicles have cost-competitive electric options compared to conventional vehicles, are near-replacement age, and had similar performance capabilities of gasoline vehicles.

The project team started by reviewing available EVs to determine which vehicle categories have market-ready EV alternatives, and then calculating incremental cost and payback periods to identify which categories are feasible for adoption in the near-term. More details on this analysis methodology are available in Appendix 3: Fleet Analysis Methodology.

Table 9 shows the four vehicle categories in Waupun's fleet for which EVs are available and are currently cost-competitive with gasoline-powered alternatives. The current vehicle column shows an existing vehicle in that category in Waupun's fleet, and the new gasoline vehicle benchmark lists the approximate cost and fuel efficiency rating for a new conventional vehicle in the same category. The EV incremental cost is the difference between the cost of the new conventional vehicle and the cost of the corresponding EV. It includes the expected reduction in cost from Inflation Reduction Act credits (up to $7,500) for each vehicle.[5] The cost savings per mile is the reduced per mile cost of fueling and maintaining the EV instead of the conventional vehicle. Miles for financial payback indicates the number of miles and years after which the cumulative benefit of the lower cost of driving the EV would surpass the higher cost of purchasing the EV.

*Table 9. Potential EV Alternatives by Vehicle Category*

| Category | Current Vehicle | New gasoline vehicle benchmark | Ex. EV Alternative | EV Incremental Cost | Cost Savings/Mile | Miles for Financial Payback |
|---|---|---|---|---|---|---|
| **Large Sedan** | Chevrolet Impala | 31 mpg $30,933 | Ford Mach-E | $4,600 | $0.088 | 52,000 |
| **Large SUV** | Chevrolet Tahoe | 17 mpg $54,200 | Mazda CX-90 PHEV | $0 | $0.143 | 0 |
| **Police Patrol** | Ford Explorer | 20 mpg $41,800 | Ford Lightning Pro SSV[6] | $10,700 | $0.123 | 87,000 (~5.5 years) |
| **Full-size Pickup** | Chevrolet Silverado 1500 | 20 mpg $41,800 | Ford F150 Lightning | $8,500 | $0.123 | 70,000 (~17.7 years) |

Based on this analysis, commercially available EVs in the four categories shown in Table 9 could replace 47%t of the City's on-road vehicles. Nine Waupun vehicles are 11 or more years old and are in a category for which a cost-competitive EV is available.

Instead of an immediate full transition, the Project team recommends initially purchasing 2-3 EVs through the City's regular vehicle replacement process and collecting data and stakeholder feedback to inform how it transitions additional vehicles. Potential candidates for replacement with an EV include a 2008 Chevrolet Impala (large car), a 2003 Chevrolet Silverado 1500, and a 2016 Ford Explorer, used as a police patrol vehicle.[7] Replacing the three vehicles recommended for the pilot with the corresponding EV alternatives shown in Table 9 would generate $3,180 in annual operating cost savings and avoid 4 tons of $CO_2$ emissions. This amounts to roughly an over 50% reduction in costs and almost a 35% reduction in emissions. The emissions reduction would be even larger with the addition of solar at the buildings.

If outside factors prevent one or more of the recommended vehicles from being replaced with an EV, other similar vehicles owned by the City should be considered.

[5] The value of any available Federal tax credits are applied to the EV MSRP to calculate the EV incremental cost.
[6] Based on feedback from City of Waupun, we model an option for replacing police vehicles with F150s. Another option is to replace with Ford Mach-E SUVs.
[7] Due to demand vehicle use patterns and high-performance requirements, police patrol vehicles have a shorter vehicle replacement cycle compared to other types of vehicles.

## Pilot Component 2: Install EV Charging Stations

The City will need to install adequate EV charging stations so that its vehicles can be sufficiently charged to meet their daily service requirements. Level 2 charging stations require 240V electric service and can fully charge a vehicle in 4-10 hours, depending on the battery capacity of the vehicle. Level 1 chargers use standard 120V electric service, but are unable to fully recharge a battery overnight, while Level 3 chargers can fully recharge a vehicle in less than 30 minutes but are much more expensive than Level 2 chargers. Table 10 summarizes the three levels of EV charging stations.

The costs shown for Level 1 and Level 2 chargers in Table 10 indicate typical ranges for the combined cost of the station hardware, electrical upgrades, and electrician labor to install each EV charging port. The hardware cost for Level 2 charging stations is modest; however, installing conduit between existing electrical panels and the location of the charging station and upgrading electrical service (if necessary) can add complexity and expense to installing the stations. Due to the wide variation in the costs of installing the high voltage electrical service for Level 3 stations, the cost listed for Level 3 stations only represents the material expenses.

*Table 10. EV Charging Station Types*

| Charger type | Range miles per charging hour | Uses | Installed cost per port (est.) |
|---|---|---|---|
| Level 1 (120V AC) | ~5 | Home charging | ~$1,200 - $1,500 |
| Level 2 (240V AC) | ~25 | Home, workplace, and public charging (most common) | ~$1,500 - $4,200 |
| Level 3 (DC) | 200+ | Public charging; transportation corridors | ~$20,000 - $150,000 (Hardware only) |

Based on the understanding that the pilot vehicles will typically be off-duty overnight, we recommend installing Level 2 chargers at the Safety Building and at the DPW Garage. In planning for EV chargers at these locations and other municipal facilities in the future, the project team recommends the following:

- Assess total future electrical service needs when upgrading for new vehicle charging stations. When planning for any electrical service upgrades or laying of new conduit, assess total potential electric vehicles that may be stationed at the location and the corresponding associated number of charging stations needed. Support long-term cost savings by including future needs in current upgrade plans.
- Consider how many vehicles a single charger can support. In Waupun, average daily miles driven for vehicles recommended for replacement suggests that EV alternatives may not require daily charging,[8] thus allowing one level 2 charging station to support two or three EVs. However, the City may choose to plan for a worst-case scenario and install one level 2 charger per EV that it purchases so that all vehicles can charge simultaneously.





[8] Statement is based on a finding that the average miles driven per workday for most City vehicles is less than half of the advertised driving range between charges for typical EV models.

## Pilot Component 3: Train city staff to drive and maintain electric vehicles

City staff who drive an EV during the pilot may have questions about the vehicle's driving range, how to charge the vehicle, when the vehicle should be charged, and any differences between driving an EV and driving a conventional vehicle.

To help answer these questions, the City should identify an EV ambassador - either a staff person or a dealership representative. The ambassador can provide a brief EV orientation to discuss the benefits of the vehicles and answer any remaining questions. After the pilot, those staff who drove the pilot EV may take on the roles of "EV ambassador" as additional staff start using the electric vehicles. The City should prepare a draft of an internal policy document that outlines rules for using the EVs. At a minimum, the rules and supporting materials should provide for:

- Prohibiting non-EVs from parking at municipal charging stations.
- The conditions (level of charge, frequency, time of day, other) under which a driver should charge a vehicle after use.
- A map of public charging stations in the Waupun area. The City may also consider creating an account with a public charging station provider, such as Plug Share or Charge Point to facilitate accounting for charging municipal vehicles at public charging stations.
- Protocols for tracking and allocating costs for electricity used to charge vehicles.
- Procedure for reimbursing driver expenses for use of non-municipal charging stations, when needed.

EVs have fewer moving parts than gasoline or diesel vehicles and require less maintenance. City staff who maintain vehicles may be able to reduce time spent on routine maintenance as Waupun adopts EVs. However, to help alleviate concerns from maintenance staff, we recommend that the City's vehicle maintenance staff receive education on this topic. Most EV manufacturers offer training on maintaining electric vehicles and how it differs from ICEs.

As another point of training and education, Waupun may benefit from contacting other municipalities in Wisconsin that have successfully introduced EVs into their fleets. For example, the City of Madison has emerged as a leader in transitioning its fleet from gas and diesel vehicles to electric models and often offers opportunities for other cities to test their vehicles or discuss EV experiences.

## Recommendation 2: Use estimated total cost of vehicle ownership to guide purchasing

The analysis of Waupun's fleet identified 15 vehicles for which there are cost-competitive EV options that would save the City money in the long-run and reduce emissions. In addition, the EV market is rapidly changing with new models being announced frequently and the cost of new EVs decreasing.

To reflect this changing market and the benefits of EVs, we recommend that the City adopt a vehicle purchasing policy so that it prioritizes selecting vehicles that offer the lowest total cost of ownership (TCO), rather than the lowest purchase price, while still meeting the City's performance requirements for the vehicle. A TCO-based purchasing policy will ensure that future decisions about fleet transitions reflect the changing costs of EVs vs ICEs and the long-term operational cost savings potential of EVs. The analysis should incorporate the following components:

- Upfront cost differential
- Ongoing fuel costs: cost to charge an EV vs. cost to purchase gasoline or diesel needed for an ICE
- Maintenance costs
- Forecasted resale values of both vehicles

Table 11 summarizes which vehicle has the cost advantage across factors.

*Table 11. EV vs conventional vehicle cost comparisons - upfront and operating*

| Cost of Ownership Factor | Advantage? |
|---|---|
| Purchase Cost | Cost differentials between EV and conventional vary by vehicle category |
| Fuel Cost | Fuel cost per mile lower for EVs than for all conventional vehicles |
| Maintenance Cost | Studies show approximately 50% lower maintenance costs for EVs. [9] |
| Resale Value | Some analyses have shown higher resale value for EV, but irregularities in markets for all vehicles from 2020 – 2023 create uncertainty. |

A TCO purchasing policy will gradually lead to adoption of EVs across vehicle types. Table 12 shows the annual operating cost saving and emissions reduction potential of replacing eligible vehicles with EVs that have a lower TCO than conventional vehicles. The operating cost savings value includes savings from both reduced fuel costs and reduced maintenance expenses. The $CO_2$ savings represent around 12% of all fleet emissions, and fuel cost savings alone represent close to 18% savings compared to all current fuel costs. The $CO_2$ savings would be larger if vehicles were charged using renewable energy.

*Table 12. Potential annual savings from adding EVs to City fleet*

| Vehicle category | Operating Cost Savings | $CO_2$ Emissions Savings |
|---|---|---|
| **Large Car** | $1,465 | 1.7 |
| **Large SUV** | $825 | 1.0 |
| **Police** | $14,755 | 16.9 |
| **Full Size Pickup** | $1,940 | 2.2 |
| **Total** | **$18,985** | **21.8** |

Another way for a municipal fleet to save money is to optimize the total number of vehicles in the fleet. For example, there are several vehicles in the City fleet that are driven less than 5,000 miles per year. Low annual mileage may create opportunities for Waupun to use fewer vehicles to complete the same set of services. To implement this in practice, at the time of purchasing, the City should review the proposed use of the vehicle, as well as the actual use of other similar vehicles to determine whether uses may be consolidated into a single vehicle. A new vehicle would only be purchased if leaders determined that the services for which the proposed vehicle would be used could not be performed with an existing vehicle in the fleet.

[9] Harto, C. *Electric Vehicle Ownership Costs: Chapter 2 – Maintenance.* Consumer Reports. September, 2020. (https://advocacy.consumerreports.org/wp-content/uploads/2020/09/Maintenance-Cost-White-Paper-9.24.20-1.pdf)

## Recommendation 3: Consider how the City can advance municipal and public EV charging

### Use EV-ready guidelines during municipal construction or renovation

Adding electric vehicles to the City of Waupun's fleet will require the City to install adequate EV charging infrastructure at its facilities. Based on the types of EVs that the City may add to its fleet and the use patterns (daily miles driven and times of use), the City will most effectively meet its EV charging needs by installing Level 2 charging stations.

Rather than laying conduit and upgrading electrical service as needed to meet increasing charging needs, the City can reduce costs by including EV-capability or EV-readiness into the plans for all new municipal facilities and into any renovations of existing municipal facilities.

For each municipal new construction and renovation project, the City should evaluate the total number of light duty municipal fleet vehicles that may regularly be parked at the facility, which translates into number of stations. After determining the number of charging stations needed, the City may incorporate an appropriate number of EV-capable and EV-ready parking spots into facility plans so that it can avoid additional costs in the future for piecemeal electrical upgrades to meet growing need for EV charging stations.

**EV-Capable**: there is sufficient electrical panel capacity for a charging station with a dedicated branch circuit and a continuous raceway from the panel to the future EV parking spot

**EV-Ready**: there is adequate electrical panel capacity and raceway *with conduit, ending at a junction box or 240V outlet* at the EV parking location

### Work with partners to install public charging for residents and travelers

Currently, there are two public charging stations in the City and the two next closest stations are in Beaver Dam and Mayville. As more Waupun residents purchase electric vehicles, there may be increasing demand or expectations for public-facing charging stations at some municipal facilities and at other publicly-available locations in the community.

EV charging stations are being installed by a variety of partners across the United States – private businesses, state and local governments, and utilities. The project team identified several ways that the City can support development of robust public charging infrastructure in Waupun.

- Engage with Wisconsin DOT to optimize their placement of EV chargers near Waupun. The Wisconsin Department of Transportation approved the Wisconsin Electric Vehicle Infrastructure (WEVI) Plan in September 2022. The WEVI plan identifies U.S. Hwy 151 exits 144 and 146, near Waupun as gaps in current EV charging infrastructure in the State's transportation corridors and therefore future priorities. The City should engage with the Wisconsin DOT to ensure placement encourages travelers to stop in Waupun for charging. This can lead to additional visits at local restaurants, grocery stores, and retail locations.
- Highlight EV charging infrastructure incentives for residents or businesses. Most residents in Waupun will primarily charge at home or work. Waupun Utilities offers a $250 incentive for fast EV charging that should be highlighted for residents and businesses.
- Consider appropriate areas for installations of chargers. Municipal facilities that residents visit for an extended period, such as the library and the aquatic center, may be ideal locations for public charging stations. Additionally, encourage chargers close to multifamily buildings as those residents likely have the lowest ability to add a charger in their home.
- Work with partners to determine and install an adequate mix of level 2 and 3 charging. A mix of Level 2 and 3 charging across the City is the ideal charging infrastructure. Level 3 chargers are essential for long-route drivers that may be passing by Waupun while Level 2 chargers are ideal for in-town drivers. Level 3 chargers should be located close to Highway 151 or close to retail and restaurant locations in the City, while Level 2 chargers should be close to multifamily housing and at places residents usually spend an hour or more. We would also encourage the City to reach out to organizations like Electrify America and ask them to consider adding Level 3 charging stations within the City limits.

# Funding Opportunities for Recommendations

The cost of the upgrades identified in this energy plan is substantial and may be a barrier to implementing some of the recommended measures. This section is intended to provide an overview of funding opportunities for the various upgrades identified in the report.

## Inflation Reduction Act

The Inflation Reduction Act (IRA) represents an unprecedented amount of funding for energy and climate actions. The IRA channels a substantial amount of its funding through tax credits and rebates for renewable energy and fleet. Through this funding, it also includes a provision, direct pay, that makes non-taxable entities eligible for the tax credits. The alternative vehicle tax credits have a limit per vehicle but there are no limits on total amount of projects rebated in a year or total amount of money the City can receive in a year. All credits are available starting for any projects implementing in 2023 and extend to 2032.

One item to point out is that commercial vehicles must be purchased from a qualified manufacturer.[10] This is less restrictive than the requirements for residential purchases of EVs.

*Table 13. Eligible Tax Credits for Direct Pay*

| | Renewable Energy | Alternative Vehicles |
|---|---|---|
| **Energy Plan Items** | Solar installations<br>Geothermal | Electric vehicle or PHEV purchases |
| **Amount** | 30% of upfront cost | 30% of vehicle cost (or 15% for PHEVs) or incremental cost compared to ICE |
| **Limit** | - | $40,000 for vehicles over 14,000 lbs<br>$7,500 for vehicles under 14,000 lbs |
| **Bonus** | 10% if meets domestic content requirements for steel and iron | - |
| **Restrictions** | - | From a qualified manufacturer |

The IRS has recently released initial guidance on how entities can receive direct pay. The set of steps are listed below. More guidance is expected to be released by the end of 2023. The City of Waupun should work with a tax expert once they identify a project they would like to install.

*Figure 12. Inflation Reduction Act direct pay – steps for receiving credit*


[10] A list of qualified commercial vehicles is here: https://www.irs.gov/credits-deductions/manufacturers-for-qualified-commercial-clean-vehicle-credit

## Focus on Energy and Local Utility Incentives

Waupun Utilities participates in Focus on Energy statewide incentives for renewable energy installations and energy efficiency upgrades and installations. It's recommended that the City provide a copy of this report to its Energy Advisor and ask for assistance in identifying the best way to access rebates. The amount available determines on the measure and often specific characteristics of the equipment, such as the size of the solar system or efficiency of the new building equipment.

In addition to those incentives, Waupun Utilities offers supplemental incentives for certain efficiency measures and offers an electric vehicle charging incentive. The city should collaborate directly with Waupun Utilities on understanding the potential applicability of those incentives.

## Other Grants and Opportunities

Other grants and opportunities through the state government or federal government also could potentially provide funding for installation of these projects. The state will receive an Energy Efficiency Community Block Grant (EECBG) of $2.3 million and 60% ($1.38 million) must be passed along to local governments not eligible for formula funding. Waupun should look for opportunities for funding from the state in early 2024. Additionally, future rounds of the Energy Innovation Grant Program grant program would be a good opportunity to apply for an innovative new heating system or solar installation.

# Appendix 1: Individual Building Results

## Waupun Library


**Size**: 25,647 ft$^2$

**Age:** Original construction in 1968 with additions in 1997 and 2008.

**Existing heating and cooling system:** Rooftop units and several furnaces with split system air conditioners.

**Electricity Use:** 145,000 kWh

**Natural Gas Use:** 8,020 therms

**EUI:** 53.8 kBtu/square foot. Significantly better than median from comparable buildings in region.

Waupun Library has made several improvements in the last several years, including a full LED replacement and partial roof replacement in 2017. The building also uses regular thermostat setbacks and setups and implements regular maintenance.

Table 14 summarizes the recommended measures between high priority and end-of-life. The end-of-life measures' payback period is not included as it depends on incremental cost compared to the other option being considered at replacement time. Maintenance refresh does not have a payback as the first cost is zero.

*Table 14. Waupun Public Library measure prioritization and estimated savings*

| Improvement measure | Priority | First Cost | Annual Utilty Cost Savings | | Annual Energy Savings | | Simple Payback | Annual Carbon Savings | |
|---|---|---|---|---|---|---|---|---|---|
| | | $ | $ | (%) | Electric Savings (%) | Gas Savings (%) | Years | Tons $CO_2e$ | % |
| Maintenance refresh | High | $0 | $200 | 1% | 1% | 1% | - | 1.2 | 1% |
| Low flow fixture and aerators | High | $50 | $70 | 0% | 0% | 1% | Less than 1 | 0.4 | 0% |
| Insulation upgrade - Roof | EOL | $27,700 | $2,100 | 10% | 5% | 25% | - | 14.5 | 12% |
| Insulation upgrade - Walls | EOL | >$100,000 | $1,600 | 8% | 3% | 20% | - | 10.9 | 9% |
| Air sealing | EOL | $19,800 | $300 | 1% | 0% | 4% | - | 1.7 | 1% |
| Upgrade windows | EOL | >$100,000 | $500 | 2% | 2% | 3% | - | 3.1 | 2% |
| New packaged RTU | EOL | $96,200 | $800 | 4% | 5% | 0% | - | 4.4 | 4% |
| ENERGY STAR residential refrigerator | EOL | $1,600 | $30 | 0% | 0% | 0% | - | 0.1 | 0% |
| **Total Priority Measures** | High | **$ 50** | **$ 270** | **1%** | **1%** | **2%** | **Less than 1** | **1.6** | **1%** |

## High Priority: Maintenance Refresh

Next Step: Implement any of the steps below that can be completed by facilities staff.

We recommend a basic maintenance refresh be done every couple of years. It can be primarily carried out by facilities staff or local contractors and have an immediate impact on energy consumption. Items for the library include:

- Check/replace door seals; make sure windows operate and seal properly.
- Air seal around windows
- Air seal exterior walls and ceilings around accessible plumbing, electrical, and HVAC penetrations.
- Air seal and insulate roof access hatch if needed.

## High Priority: Low Flow Aerators

Next Step: Review faucets and install aerators on faucets without existing aerators

Low-flow faucets are an easy do-it-yourself upgrade that can result in a quick payback. Standard aerators deliver 2.2 gallons per minute (gpm) while low-flow versions should deliver 1.0 gpm or less.

## EOL: Roof and Wall Insulation with Air Sealing

Next Step: Have an engineer or contractor inspect current insulation and determine how much additional insulation should be added where feasible.

We recommend roof insulation be improved to R-35 or better the next time the waterproof roof membrane is replaced. Original portions of the library constructed in 1968 have little to no insulation. Walls appear to be constructed of bare concrete block or brick with no insulation. This lack of insulation results in high gas consumption. Improving the wall insulation and wall air sealing, however, would be a major challenge since the interior surface of exterior walls are often covered with drywall or other finishes, and the exterior surface of walls are architectural brick. Wall insulation with air sealing would likely need to be part of a larger remodel of the facility's exterior.

## EOL: Upgrade Windows

Next Step: Obtain a quote from a qualified contractor for window replacements.

We recommend replacing windows as they reach end-of-life to address the warm conditions in the second floor reading area. Window films have been retrofitted onto some of the windows in the main entrance, which have resulted in some marginal improvements in reducing solar heat gain but has also caused some issues such as glass breakage. When these windows (and nearby skylights) reach their effective useful life, specify products certified by ENERGY STAR® or by the National Fenestration Rating Council (NFRC) and look for products with a U-Value of less than 0.30 and a Solar Heat Gain Coefficient (SHGC) of less than 0.25.

## EOL: High Efficiency Packaged Rooftop HVAC Equipment or Heat Pumps

Next Step: Have a contractor review current systems and determine replacement plan for all heating and cooling equipment.

At end of useful life, it is recommended that the City procure new rooftop and split-system equipment with efficiency levels well above code minimum or consider adoption of a heat pump system. Both RTUs and split-systems can be replaced with heat pump technology that uses electricity efficiently to both heat and cool rather than cooling-only. Determining a replacement plan before failure will allow for better budgeting and easier implementation of emerging technologies such as packaged cold-climate heat pump rooftop units with gas backup.

## EOL: ENERGYSTAR Appliances

Next Step: Review an ENERGY STAR list before purchase of new refrigerator or other new appliances.[11]

When the refrigerator in the break room reaches end of life, we recommend replacement with an ENERGY STAR model. ENERGY STAR energy efficient products should also be implemented for all key measures.

[11] A list of qualified ENERGYSTAR products is here: https://www.energystar.gov/products/products_list

## Waupun Safety Building

**Size:** 21,381 ft$^2$

**Age:** 1986 with a 2009 addition

**Existing heating and cooling system:** Several furnaces with split system air conditioners.

**Electricity Use:** ~122,000 kWh

**Natural Gas Use:** ~7,500 therms

**EUI:** 59.2 kBtu/square foot. Significantly better than median from comparable buildings in region.

The Safety Building implemented a full LED replacement in 2018 and has established habits around turning lights off when rooms are not in use. The occupants expressed concerns about comfort in the winter and thermostat functionality. The material of the building makes insulation upgrades expensive and difficult to install. The recommended measures below work to address the concerns while keeping cost in mind.

Table 15 summarizes the recommended measures for the Safety Building. The end-of-life measures payback period is not included as it depends on incremental cost compared to the other option being considered at replacement time. The measures with no upfront cost also do not include a simple payback.

*Table 15. Waupun Safety Building recommended measures, first cost, and savings*

| Improvement measure | Priority | | First Cost | Annual Utilty Cost Savings | | Simple Payback | Annual Energy Savings | | Annual Carbon Savings | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | $ | $ | (%) | Years | Electric Savings (%) | Gas Savings (%) | Tons $CO_2e$ | % |
| Multiple Retrocommissioning Measures | | High | $10,700 | $900 | 5% | 12 | 5% | 5% | 6.4 | 5% |
| Maintenance Refresh | | High | $0 | $1,200 | 6% | - | 7% | 7% | 8.5 | 7% |
| Remove Electric Space Heaters | | High | $0 | $400 | 2% | - | 7% | -6% | 2.1 | 2% |
| Low Flow Faucet Aerators | | High | $100 | $100 | 0% | Less than 1 | 0% | 0% | 0.2 | 0% |
| Energy Star Air Conditioners | | EOL | $44,800 | $400 | 2% | - | 3% | 0% | 2.1 | 2% |
| Replace Windows | | EOL | $4,800 | $300 | 1% | - | 2% | 0% | 1.5 | 1% |
| **Total Priority Measures** | | High | **$ 10,800** | **$2,600** | **14%** | **4** | **18%** | **6%** | **17.2** | **13%** |

### High Priority: Retrocommissioning Measures

Next Step: Focus on Energy provides incentives and a list of qualified contractors for retrocommissioning or building tune-ups. Contact them to understand potential programs and enroll.[12]

We recommend the Safety Building explore retrocommissioning to address the concerns around comfort and thermostat functionality in the building. Retrocommissioning is a process of servicing and repairing existing heating and air conditioning equipment to restore it to nearly its original level of performance. Although the retrcommissioning payback is somewhat longer, we recommend this measure to address current comfort issues in the building. Retrocommissioning for the safety building would include furnace and air conditioner tune-ups, air duct sealing and cleaning, ventilation system testing and balancing, replacing furnace filters, and testing thermostat setbacks.

### High Priority: Maintenance Refresh

Next Step: Implement any energy efficiency measures that can be completed by facilities staff.

We recommend a basic maintenance refresh be done every couple of years. For the Safety Building, the maintenance refresh should focus on air sealing. Weatherstripping and sealing any openings will improve

[12] Information on Focus' retrocommissioning incentives are here: https://focusonenergy.com/business/building-optimization

comfort. We believe this work can be accomplished by facilities staff or local contractors and have an immediate impact on energy consumption.

### High Priority: Remove Electric Space Heaters

Next Step: Implement other measures to improve comfort and then limit electric space heaters.

We recommend limiting the number of electric space heaters used in offices. The building has a significant increase in electric bills during the winter months which can be attributed to running these space heaters. The measures described above should improve the heating system's performance and eliminate excess heating loads, allowing these space heaters to be either removed or not operated.

### High Priority: Low Flow Aerators

Next Step: Audit all faucets and install aerators on faucets without existing aerators.

Low-flow faucets are an easy do-it-yourself upgrade that can result in a quick payback. Standard aerators deliver 2.2 gallons per minute (gpm) while low-flow versions should deliver 1.0 gpm or less.

### EOL: Replace Windows

Next Step: Obtain a quote from a qualified contractor for window replacements.

We recommend replacing windows as they reach end-of-life, especially in the original wing of the building. The building's exterior windows are aging and an opportunity exists to replace them with better insulating windows. New windows also produce less solar heat gain (excess heating caused by the non-visible portion of solar radiation shining through the windows). When replacing windows, specify products certified by ENERGY STAR® or by the National Fenestration Rating Council (NFRC) and look for products with a U-Value of less than 0.30 and a Solar Heat Gain Coefficient (SHGC) of less than 0.25.

### EOL: ENERGY STAR Air Conditioners

Next Step: Discuss air conditioning replacement with Focus on Energy. Incentives are available for qualifying products.[13]

We recommend replacing the air conditioners that are nearing the end of their service lives with new ENERGY STAR® certified air conditioners. This will help lower electric bills in the summer. Prioritize replacing the oldest air conditioners first. The City could also consider heat pump options to replace existing furnaces and AC units at the same time. Determining a replacement plan before failure will allow for better budgeting and easier implementation of heat pumps.

[13] Focus on Energy incentive list is located here: https://s3.us-east-1.amazonaws.com/focusonenergy/staging/inline-files/2023/BIZ-Summary_of_Services_and_Incentives.pdf

## Waupun City Hall Heating

**Size**: 25,647 ft$^2$

**Age:** Original construction in 1928

**Existing heating and cooling system:** Steam radiators and air conditioning system in offices and conference rooms

**Electricity Use:** 60,000 kWh

**Natural Gas Use:** ~14,000 therms (higher natural gas use than expected for age and condition of building)

**EUI:** 85.4 kBtu/square foot. Better than median EUI of comparable buildings in climate zone

The project team looked specifically at the City Hall steam boiler system. The boiler is near end-of-life and needs replacement. The steam boiler piping is also nearing the end of its life, as staff had identified four pipes that are corroding and will likely need replacement. Because the City Hall is a historic landmark, city staff are concerned about ripping out and installing new steam or hot water piping throughout the building.

The age of the system and the uninsulated condensate return pipes are likely contributing to higher natural gas use. The team modeled alternative solutions for the City Hall heating system.

Table 16 summarizes the various options and longer descriptions are below. The first costs are estimated for the heating systems – however the historic characteristics of these existing system may increase these costs significantly. The negative electricity savings from VRF and geothermal are a result of that each system will add air conditioning to the theater and thus increase overall air conditioning energy use in the building.

*Table 16. City Hall heating system replacements*

| ıent measure | Priority | | First Cost | Annual Utilty Cost Savings | | Simple Payback | Annual Energy Savings | | Annual Carbon Savings | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | $ | $ | (%) | Years | Electric Savings (%) | Gas Savings (%) | Tons $CO_2e$ | % |
| Stream trap study / repair | | High | $3,100 | $1,200 | 5% | 3 | 0% | 10% | 8.5 | 6% |
| Steam Pipe Insulation | | High | $3,300 | $2,800 | 13% | 1 | 0% | 24% | 21.0 | 16% |
| Hot Water Boiler | | EOL | >$550,000 | $2,100 | 10% | - | 0% | 18% | 15.8 | 12% |
| VRF | | EOL | >$650,000 | -$700 | -3% | - | -116% | 88% | 25.2 | 19% |
| Geothermal System | | EOL | >$750,000 | $1,100 | 5% | - | -105% | 94% | 35.5 | 27% |
| **Total Priority Measures** | | High | **$ 6,400** | **$ 4,000** | **18%** | **$ 2** | **0%** | **34%** | **29.5** | **22%** |

## Option A: Steam Trap Repair and Steam Pipe Insulation

The repair of the current steam system is the lowest cost option but will lead to minimal savings and not fully address the concerns with the heating system. It would involve replacing the existing system with a new steam boiler, repairing pipes, repairing steam traps and insulating steam pipes.

## Option B: Hot Water Boiler System

Another option is to replace the steam system with an entirely new hot water condensing boiler system. The new boiler would be more efficient and save energy. However, it would require significant work to replace the existing steam radiators and install new piping throughout the building.

## Option C: Variable Refrigerant Flow (VRF) System

A third option is to add a VRF system or heat pumps that both heat and cool the space with refrigerant run to each space. Replacing the steam system with a VRF still requires work throughout the building, but the smaller refrigerant lines require less space than hot water and steam. Radiators could be replaced with heat pumps and heat pump outdoor units could go on the roof with a cold-climate design. As the air conditioning was

recently replaced in many spaces, it is a less economical solution as it would be replacing relatively new AC. It could add some air conditioning to the theater. VRF systems are well suited to historic renovations as it is easier and less expensive to run refrigerant piping than the larger piping of stream or hot water.

### Option D: Geothermal Heat Pump System

Geothermal heat would require finding a location for a large borefield outside of the building, but if there is a location, it has the most energy savings. It also has the potential for the lowest cost due to the federal Inflation Reduction Act, which offers direct pay option as replacement for tax credits up to 30% of the cost of a geothermal system.

## Next Steps

It is recommended that the City contact a heating contractor to discuss the options for the City Hall heating system and discuss internally the benefits and costs of the various options. Table 17 summarizes the considerations for each heating system.

*Table 17. Summary of heating replacement options*

| | First Cost | Maintenance | Energy Cost Savings | Other considerations |
|---|---|---|---|---|
| **Steam Remediation** | $ | 🔴 | 🔴 | Need to replace corroding pipes |
| **Hot Water Boiler** | $$$ | 🟡 | 🟡 | |
| **VRF** | $$$ | 🟢 | 🔴 | A/C for Theater, exterior equipment, easier retrofit |
| **Geothermal Heat pump** | $$$$* | 🟡 | 🟢 | A/C for Theater,<br>Requires large geothermal borefield |

** Inflation Reduction Act tax credits would reduce the first cost by 30%.*

🔴 Requires Review 🟡 Better 🟢 Best

# Appendix 2: Solar Methodology and Details

## Methodology

The project team identified solar opportunities by reviewing energy use profiles and roof space available by building. The project team removed the Aquatic Center, Community Center/Hockey Rink, and Heritage Museum. The Community Center had little to no energy consumption in the summer and high consumption in the winter – which is opposite of the times of year when solar panels produce the most electricity. The Aquatic Center had little space available, and the Heritage Museum had little space available and low consumption.

For the other buildings, the team started by identifying the space available by reviewing the buildings with Google satellite mapping and through discussions on roof age and condition. The satellite imaging provides the direction the roof faces and degree tilt. Buildings with south-facing roofs generally offer the most cost-effective opportunities for installing solar arrays, followed by buildings with east or west facing roofs. The degree tilt represents how angled the panels are on the roof. On average, matching the degrees of tilt for the panels to the degrees latitude of the solar array will produce the most electricity over the course of a year. If a building's roof is not tilted at this angle, panel mounting can apply a tilt that balances shading with optimal angle.

The roof space available was combined with hourly energy data and utility bill rates and entered into a technoeconomic tool, ReOpt, to find the most cost-effective solution. ReOpt takes inputs of a building's energy loads, utility rate, and based on inputs and constraints from the user optimizes the sizing of solar PV.

The analysis assumes that the net metering limit is 26 kW dC. This is the current limit set by Waupun Utilities[14] and any solar installation below this size receives the full utility retail rate (the same as what is paid) for any overproduction of solar that is sent back to the grid. Any solar size above 26 kW dC receives the buyback rate (or wholesale rate) instead. The buyback rate is lower than the retail rate and changes yearly. Both rates are only applicable when the amount of solar produced at a certain time is higher than the building's consumption. The remainder of the time the solar production is saving money as no energy must be purchased from the grid.

Other assumptions include:

- The lifetime of the system is 25 years. This is a conservative with estimates going up to 50 years.
- The estimated upfront cost is $2,500/kW for systems below 100 kW. Only bids can give real costs.
- Roof loading and electrical panel space needs to be verified by a trained design professional.
- Operations and maintenance costs are low. The largest cost is inverter replacement at 15 years

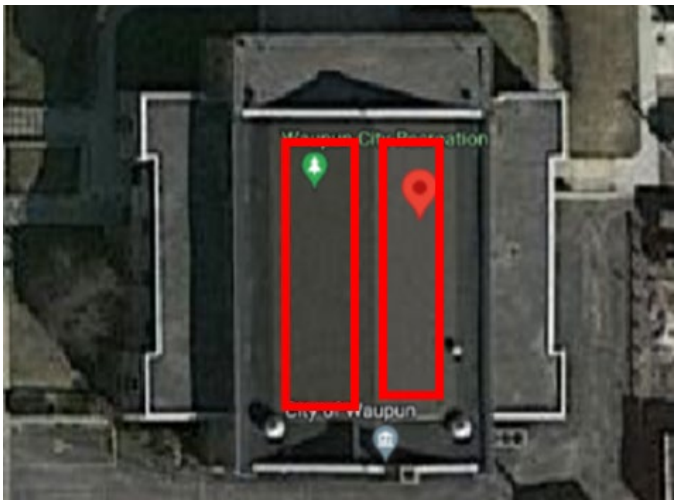
We present inputs and a set of scenarios that minimize payback period or maximize CO2 emissions for each building. Table 18 below includes a definition for each output shared for the buildings.

*Table 18. Solar analysis output definitions*

| Output | Definition |
|---|---|
| System Size | Total solar photovoltaics size in kW dc. |
| Payback (years) | Calculated as total upfront cost (after incentives) divided by first year cost savings. Shown with constant electric rates and a 1% increase each year. |
| Percent Renewable Electricity | Total electricity produced divided by total energy consumption |
| Lifetime Carbon Savings (metric tons) | Electricity consumption converted to solar. Avoided energy from grid multiplied by carbon emissions factor on hourly level. |
| Lifetime Energy Savings | Total energy bill savings over the lifetime of the solar panels (25-years). Shown with constant electric rates and a 1% increase each year. |
| Total Upfront Cost | Total initial upfront cost ($2500/kW multiplied by system size) |
| Focus on Energy Incentives[15] | Focus on Energy Business rebates |
| IRA Tax Credit | 30% direct pay through Inflation Reduction Act. |
| Total Cost | Total initial upfront cost minus rebates and tax incentives |

[14] There are currently cases being heard by the PSC to change this net metering limit or remove it. However, those cases have not been decided so at this point in time this limit still holds. If it changes in the future, payback periods may change slightly.
[15] Focus on Energy solar incentive information: https://assets.focusonenergy.com/production/inline-files/2023/RR-Solar-PV-APL.pdf

## City Hall



**Available roof space:** 2,600 square feet available. Excludes flat sections of the roof as identified as likely unable to hold solar panels.

**Utility rates:** Flat rate of $0.1095/kWh; no demand charge.

**Wholesale (buyback) energy rate:** $0.032 in off-peak; $0.045/kWh in on-peak

**Orientation:** West and east-facing at 30-degree tilt (angle of roof)

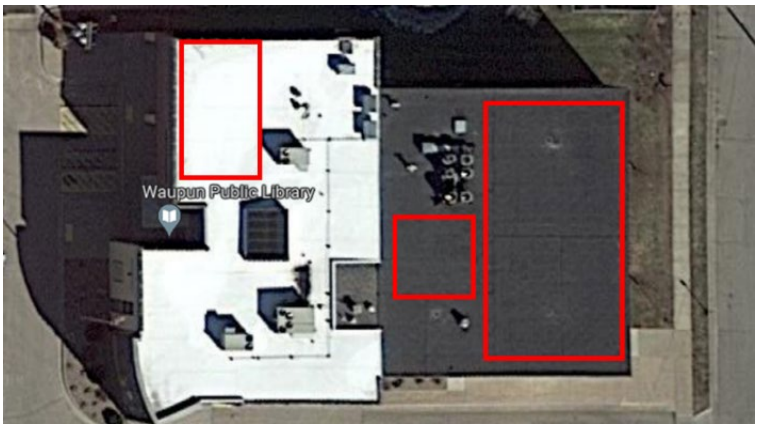
**Annual energy use:** ~60,000 kWh

Table 19 presents one option for solar arrays on City Hall. It maximizes roof space and minimizes payback.

*Table 19. City Hall recommended solar array*

| Metric | System Information |
|---|---|
| System Size | 26 kw dC |
| Payback (years) | 12.6 - 14.4 |
| Percent Renewable Electricity | 42% |
| Lifetime Carbon Savings (metric tons) | 488 |
| Lifetime Energy Savings | $72,649 - $82,900 |
| | |
| Total Upfront Cost | $65,000 |
| Focus on Energy Incentives | -$3,750 |
| IRA Tax Credit | -$19,500 |
| Total Cost | $41,750 |

## Library




**Available roof space:** 4,500 square feet available.

**Utility rates:** Time-of-use rate. $0.0615/kWh in off-peak, $0.085/kWh in on-peak; $8.5/kW demand charge in peak

**Wholesale (buyback) energy rate:** $0.032 in off-peak; $0.045/kWh in on-peak

**Orientation**: South facing at 20-degree tilt

**Annual energy use:** ~145,000 kWh

Table 20 provides system information for two separate solar installations. The first array is the cost-optimized solution with the lowest payback period. The second array maximizes space available on the roof. As the second option only slightly increases the payback period, we recommend pursuing that option.

*Table 20. Library recommended solar array*

| Metric | Cost-Optimized | Maximize Renewables |
|---|---|---|
| System Size | 37 kW dC | 45 kW dC |
| Payback (years) | 12.6 - 14.3 | 13 - 14.9 |
| Percent Renewable Electricity | 31% | 38% |
| Lifetime Carbon Savings (metric tons) | 836 | 1017 |
| Lifetime Energy Savings | $103,992 - $118,666 | $122,054 - $139,264 |
| | | |
| Total Upfront Cost | $92,500 | $112,500 |
| Focus on Energy Incentives | -$5,125 | -$6,125 |
| IRA Tax Credit | -$27,750 | -$33,750 |
| Total Cost | $59,625 | $72,625 |

## Public Works Garage

**Available roof space:** 11,800 square feet available. Only need 2,600 – 4,500 square feet.

**Utility rates:** Flat rate: $0.1095/kWh; no demand charge.

**Wholesale (buyback) energy rate:** $0.032 in off-peak; $0.045/kWh in on-peak

**Orientation:** South facing with 20-degree tilt

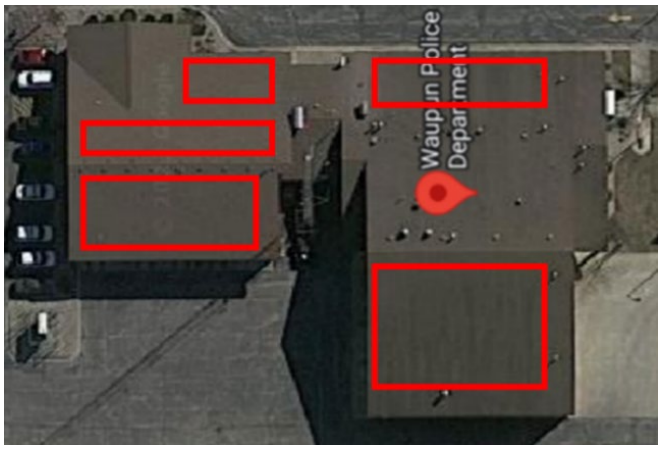
**Annual energy use:** ~71,000 kWh

Table 21 provides system information for two solar installations. The first array is the cost-optimized solution with the lowest payback period. The second option increases the percent renewable electricity to 75% but increases the payback. We recommend the second option as it is the only city facility that can serve as an example of getting close to 100% renewable electricity.

*Table 21. Public Works Garage recommended solar array*

| Metric | Cost-Optimized | Maximize Percent Renewable |
|---|---|---|
| System Size | 26 | 43 |
| Payback (years) | 10.4 - 11.8 | 14.5 - 16.6 |
| Percent Renewable Electricity | 45% | 75% |
| Lifetime Carbon Savings (metric tons) | 587 | 981 |
| Lifetime Energy Savings | $88,098 - $100,527 | $105,544 - $120,437 |
| | | |
| Total Upfront Cost | $65,000 | $108,539 |
| Focus on Energy Incentives | -$3,750 | -$5,927 |
| IRA Tax Credit | -$19,500 | -$32,562 |
| Total Cost | $41,750 | $70,050 |

## Safety Building




**Available roof space:** 8,500 square feet available.

**Utility rates:** Time-of-use rate. $0.0615/kWh in off-peak, $0.085/kWh in on-peak; $8.5/kW demand charge in peak

**Wholesale (buyback) energy rate:** $0.032 in off-peak; $0.045/kWh in on-peak

**Orientation:** Mix of east, west, and south facing with 30-degree tilt

**Annual energy use:** ~122,000 kWh

Table 22 illustrates the cost-optimized solution and the solution that maximize renewable energy. We recommend the cost-optimized solution in this situation as the larger system significantly increases payback.

*Table 22. Safety Building recommended solar array*

| Metric | Cost-Optimized | Maximize Renewables |
|---|---|---|
| System Size | 26 | 85 |
| Payback (years) | 15.8 - 18 | 21.8 - 24.8 |
| Percent Renewable Electricity | 22% | 71% |
| Lifetime Carbon Savings (metric tons) | 481 | 1574 |
| Lifetime Energy Savings | $57,870 - $66,041 | $138,573 - $158,109 |
| | | |
| Total Upfront Cost | $-65,000 | $212,500 |
| Focus on Energy Incentives | -$3,750 | -$11,125 |
| IRA Tax Credit | -$19,500 | -$63,750 |
| Total Cost | $41,750 | $137,625 |

# Appendix 3: Fleet Analysis Methodology

The analysis measured the current annual energy, cost, and emissions impacts of the City of Waupun's municipal fleet. It also applied data on current vehicles to performance metrics of new gasoline, diesel, and electricity-fueled vehicles to recommend a strategy through which the City can cost-effectively reduce the energy used and emissions generated by its vehicles. The methodology used to calculate data on current vehicles and prepare recommendations for fleet vehicle replacements is described below.

1. Calculate key performance indicators (KPIs) for municipal fleet vehicles.
    - Collected data showing the number of gallons and cost of fuel purchased for each vehicle, as well as the fuel type (gasoline, diesel, or other) during a 12-month period
    - Collected data showing the number of miles driven by each vehicle during the same 12-month period.
    - Applied data for fuel use, fuel type, and miles driven to calculate the pounds of $CO_2e$ emitted by each vehicle
    - All City-owned vehicles were assigned to one of seven categories: Large Car, Full-size Pickup Truck, Heavy-duty truck, Small SUV, Mid-size SUV, Large Truck, Street Sweeper, and "Other." [Other includes lawnmowers, and fuel trucks.]
    - Calculated the annual fuel use, fuel cost, miles driven, and CO2e emissions for all of the City's vehicles, then segmented each metric for each vehicle category.
2. Surveyed the market to identify all electric vehicles available in the existing vehicle categories in the City's fleet.
    - Limited findings to eliminate vehicles that are not yet in production or had limited market share, making them difficult for the City to obtain.
    - Within each vehicle category, identified a cost-effective EV option that met minimum driving range requirements and had a strong fuel economy (kWh/100 miles) rating to use for opportunity analysis.
    - Used the commercial clean vehicle tax credit qualified manufacturer list to reduce the assumed cost of each EV by the value of any Federal tax credit for which it may be eligible. Through the Inflation Reduction Act, municipalities have access to tax credits through a direct pay provision.
3. Surveyed the market to identify a leading gasoline or diesel-powered vehicle in the existing vehicle categories in the City fleet that the City would be likely to consider for purchase during its normal vehicle retirement and replacement process.
    - Identified cost and fuel economy metrics for each selected vehicle.
4. Used average gasoline, diesel, and electricity costs to calculate the cost of fuel used to drive one mile by the selected EV and by the selected gasoline or diesel vehicle in each vehicle category.
    - Gasoline = $3.58/gallon – Based on average per gallon gasoline cost reported for the period by five Wisconsin municipalities currently engaged in energy planning projects.
    - Diesel = $4.28/gallon - Based on average per gallon diesel cost reported for the period by five Wisconsin municipalities currently engaged in energy planning projects.
    - Electricity = $0.11/kWh – Based on U.S. Energy Information Administration (EIA) average commercial electricity cost for the State of Wisconsin.

5. Applied research by Consumer Reports[16] to estimate the average per mile maintenance costs for EVs and gasoline or diesel-powered vehicles.
6. Calculated the potential cost savings per mile that the City could obtain by purchasing an EV in place of a gasoline or diesel vehicle. If the net purchase cost of the EV exceeded the cost of the gasoline or diesel vehicle, calculated the number of miles after which the per mile cost savings from driving the EV would surpass the incrementally higher purchase cost of the EV.

[16] Harto, C. *Electric Vehicle Ownership Costs: Chapter 2 – Maintenance.* Consumer Reports. September, 2020. (https://advocacy.consumerreports.org/wp-content/uploads/2020/09/Maintenance-Cost-White-Paper-9.24.20-1.pdf)

# AGENDA SUMMARY SHEET

**MEETING DATE:** October 10, 2023

**TITLE:** Community Garden Location

**AGENDA SECTION:** Consideration/Action

**PRESENTER:** Jeff Daane

| **DEPARMTENT GOAL(S) SUPPORTED** *(if applicable)* | **FISCAL IMPACT** | |
|---|---|---|
| | | |

**ISSUE SUMMARY**

**The City is currently working with the Waupun Area School district on a piece of land on the SW corner of 801 E Lincoln St. If this location is approved we will continue to finalize agreements with the school to use this portion of the property for the garden.**

**I have spoken with the Fire Department. We need to keep the water totes within 100' of the street for filling. The school has requested 6' walk paths between the plots so that they can run their mower through to keep the weeds down.**

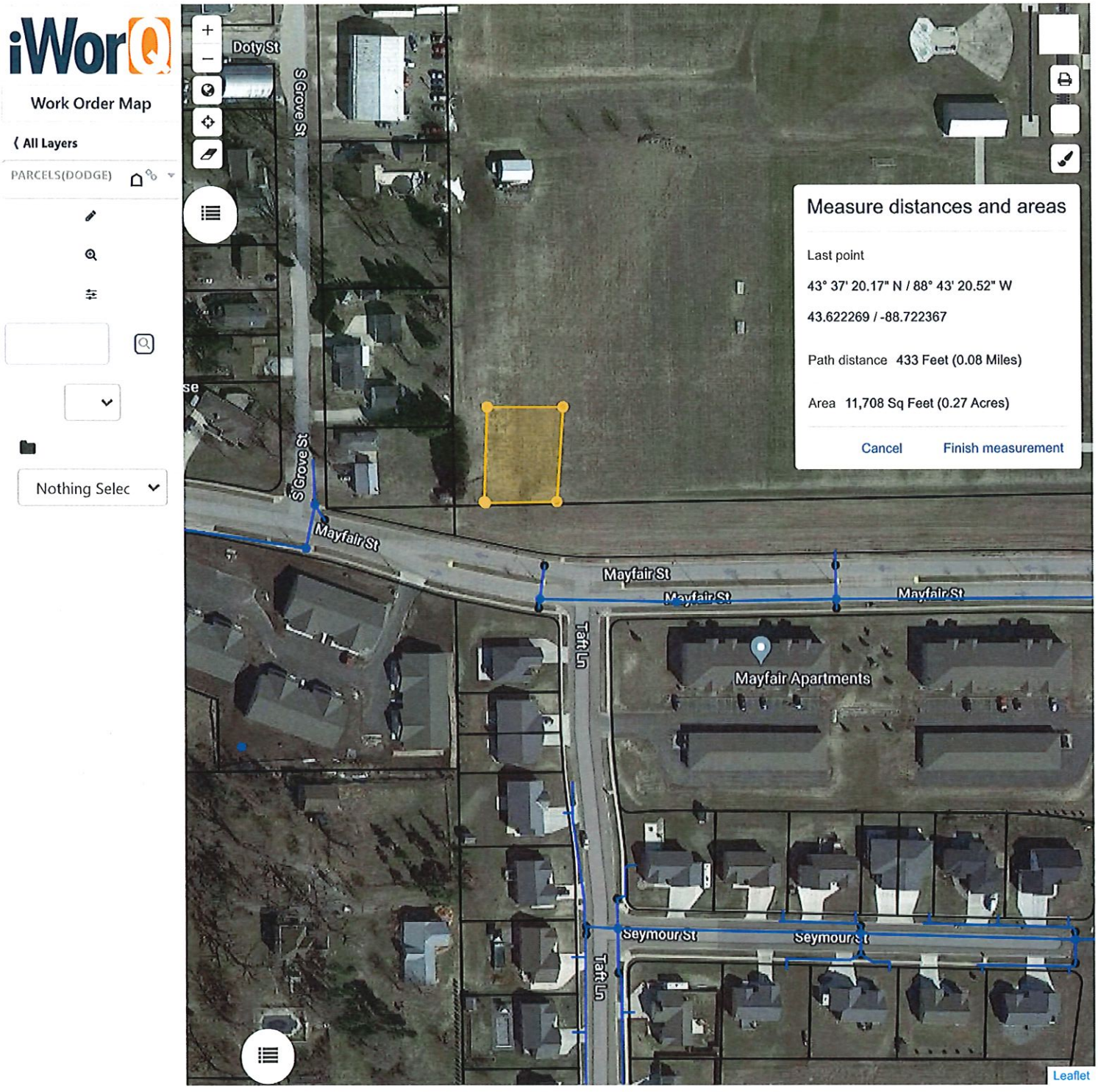
**If location and agreements are completed early enough this fall we would like to work the plot up and add compost. This way it can mellow over winter.**

**STAFF RECCOMENDATION:**
**Approve location**

**ATTACHMENTS:**
Map of future location

**RECCOMENDED MOTION:**

1. **Approve the location at the SW corner of 801 E. Lincoln St. for the community garden**


iWorQ
Work Order Map
All Layers
PARCELS(DODGE)
Nothing Selec
Doty St
S Grove St
Mayfair St
Mayfair St
Mayfair St
Mayfair St
Taft Ln
Mayfair Apartments
Seymour St
Seymour St
Taft Ln
Measure distances and areas
Last point
43° 37' 20.17" N / 88° 43' 20.52" W
43.622269 / -88.722367
Path distance 433 Feet (0.08 Miles)
Area 11,708 Sq Feet (0.27 Acres)
Cancel
Finish measurement
Leaflet

# AGENDA SUMMARY SHEET

**MEETING DATE:** October 10, 2023

**TITLE:** City property West of Rosewood Dr.

**AGENDA SECTION:** Discussion

**PRESENTER:** Jeff Daane

| **DEPARMTENT GOAL(S) SUPPORTED** *(if applicable)* | **FISCAL IMPACT** | |
|---|---|---|
| | | |

**ISSUE SUMMARY**

**The City purchased the property to help with some storm water/ flooding issues and also we continued to have complaints to have the property cleaned up. There is an old shed on the property and a small pile of fill/debris.**

**We have been working with and through the DNR on this site as there are possible wetlands. The DNR sent us over some older information that was done via fly over many years back. The wetland specialists at the DNR are very busy and will not get involved until they actually know there are wetlands present.**

**I did contact another DNR staff member we have worked on for other projects in the city. He was able to give us the go ahead to clean up the remaining wood and loose debris left behind after the wood and roof metal were removed He was also able to take a site visit on Friday September 29th to do a small wetland determination for the shed area. This is in hopes we can remove the old concrete walls and foundation. This would also allow us to dirt that area so it can both be mowed and the animals will not be able to live under the concrete foundation.**

**At this time that is all we are doing with the property cleaning it up and keeping it maintained for the neighborhood.**

**Next steps will be to have the DNR do a full wetland delineation of the property. This help confirm what the DNR has sent us over for possible wetlands or maybe change some of the boundaries.**

**STAFF RECCOMENDATION:**

**ATTACHMENTS:**
**Map of area**
**DNR wetland Map**
**Photos**

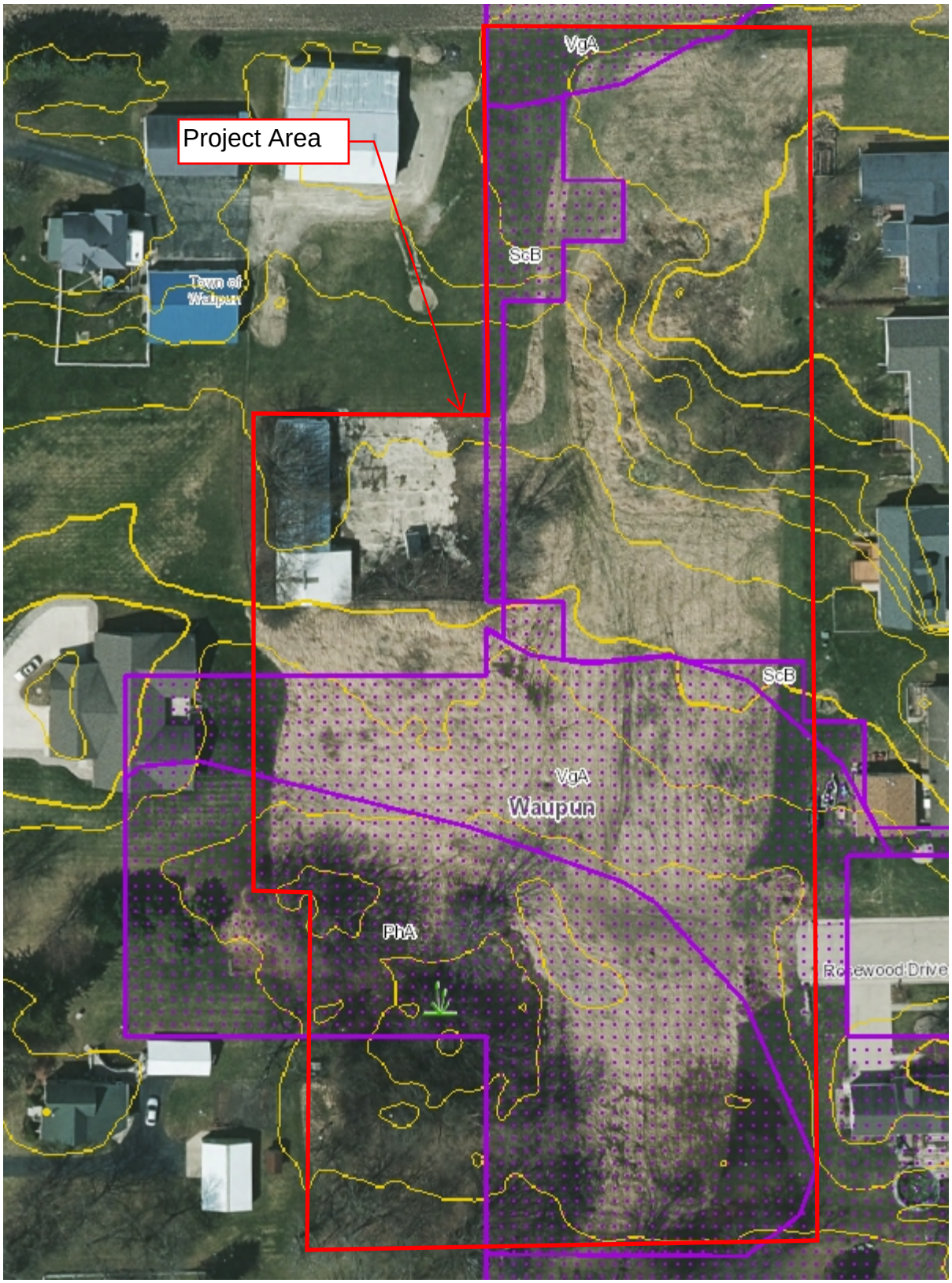
**RECCOMENDED MOTION:**

**1.**

| AGENDA ITEM: | #14 |
|---|---|

| DATE: | MAY 8, 2018 |
|---|---|

# Waupun Vacant Lots




## Legend

- Lake Class Areas
- Riverine/ditch Class Areas
- Wetland Class Areas
- Wetland Class Points
  - Dammed pond
  - Excavated pond
  - Filled/drained wetland
  - Wetland too small to delineate
  - Filled excavated pond
- Filled Points
- Wetland Class Areas
- Filled Areas
- USDA Wetspots
- Maximum Extent Wetland Indic
- Elevation Points
- Elevation in Feet
  - High : 574.681
  - Low : 148.285
- Contours
- Elevation Points
- Elevation in Feet
  - High : 574.681
  - Low : 148.285
- Contours
- Major Roads
  - County Road
  - Interstate HWY
  - State HWY
  - US HWY
- Local Roads
- Railroads
- County Boundaries
- Municipal Boundary
- State Boundary
- Tribal Lands

0.0 0 Distance / 2 0.0 Miles

1: 990

NAD_1983_HARN_Wisconsin_TM

DISCLAIMER: The information shown on these maps has been obtained from various sources, and are of varying age, reliability and resolution. These maps are not intended to be used for navigation, nor are these maps an authoritative source of information about legal land ownership or public access. No warranty, expressed or implied, is made regarding accuracy, applicability for a particular use, completeness, or legality of the information depicted on this map. For more information, see the DNR Legal Notices web page: http://dnr.wi.gov/legal/

## Notes

Notes

Looking NW at abandoned building

Looking N at abandoned building

Looking NE at abandoned building

Looking W at abandoned building

Looking N from SE corner of abandoned building

Looking NW from north central portion of site

Looking E from N boundary

Looking W from N boundary

Looking S from middle of site

Looking S from middle of site

Looking S from middle of site

Looking SE from S end of site

Looking S from S end of site