

GREENHOUSE GAS SOURCES

Three scope categories based on where emissions are generated

SCOPE 1 EMISSIONS

Direct emissions from onsite combustion and transportation.

Building sources include:

- 2 Natural gas boilers for space and water heating
- 2 Natural gas laundry dryers
- Gas range and ovens

BUILDING ELECTRIFICATION

The decarbonization plan from Inclination Engineering details a plan to replace the fossil fuel-powered equipment above with electric equipment.



SCOPE 2 EMISSIONS

Indirect emissions from purchased electricity

RENEWABLE ENERGY—ACHIEVED

The Tri Delta house uses 100% renewable electricity by purchasing renewable energy credits through DTE's MIGreen Power Program.



SCOPE 3 EMISSIONS

All other indirect emissions from purchased goods, shipping, waste, employee and resident transportation, and other sources.

INVENTORY, SOURCE, AND REDUCE

Scope 3 emissions are often unseen so a first step is to inventory them.

Reduction requires a multifaceted plan. High impact steps include:

- Compost food waste
- Increase plant-based meals
- Review suppliers' decarbonization performance
- Provide EV charging stations for residents and employees

ADDITIONAL RESOURCES:

[EPA Scope 3 Inventory Guidance](#) | [LiveZeroWaste.org](#)



DECARBONIZATION PLAN

Tri Delta Iota House

10/07/2022

Caleb Kline, P.E., Inclination Engineering

Tri Delta Iota House

718 Tappan Ave., Ann Arbor, MI

Year Built

1929

Square Feet

15,000

EnergyStar Score

69 / 100

Scope 1 Emissions

56.8 metric tons CO₂e/yr

OVERVIEW

The sorority house, a historic building in the University of Michigan's Central Campus, uses natural gas boilers for space heating and domestic hot water. These combined with natural gas laundry dryers and cooking appliances comprise the Scope 1 greenhouse gas emissions.

The electrification plan for the building includes 7 tasks which are phased from 2023 to 2030. See the timeline on the following page.

WEATHERIZATION AND VENTILATION

Air sealing the basement windows and crawl spaces improves indoor air quality and reduces winter drafts. Thermal imaging of the walls and windows identifies other top priority weatherization areas. This reduces the heating requirement of the future heat pumps. An energy recovery ventilator conserves energy while providing fresh air.

BUILDING CONTROLS

A whole building control system saves energy, increases comfort, and improves maintenance. A coordinated system throughout the building will be ready to add the new heat pump equipment.

RIGHT SIZED HEATING

Oversized heat pumps can be expensive and perform poorly. Monitoring the actual space heating and hot water demands helps ensure the new system is appropriately sized.

PLANNED RENOVATIONS

The HVAC upgrades included in the house director suite renovations will be coordinated for connection to the future heat pump system.

HEAT PUMP INSTALLATION

With all the preparation completed, an air-to-water heat pump will be installed to heat and cool the building. The heat pump will preheat the domestic hot water, while a second, cascade heat pump heats it to its final temperature.

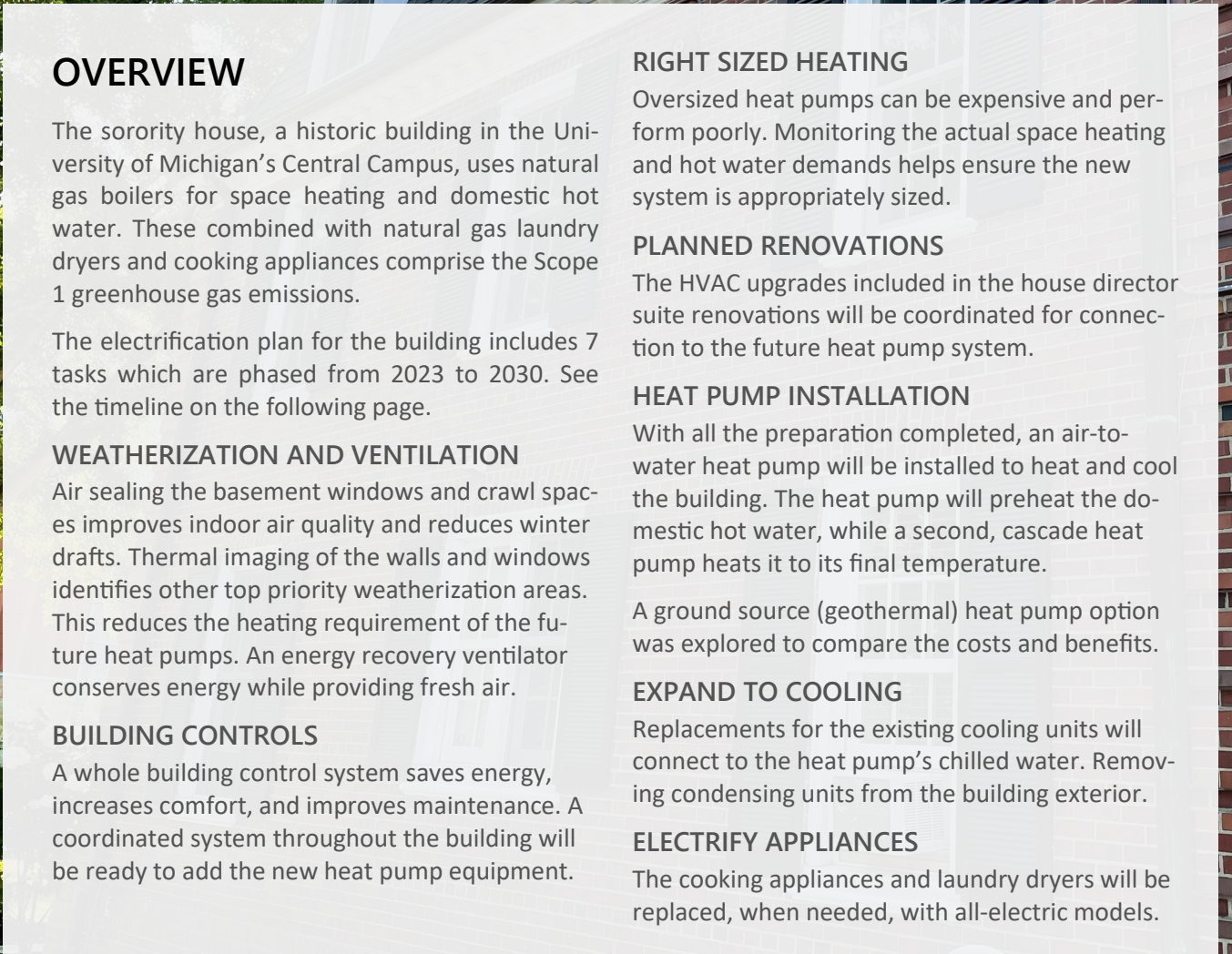
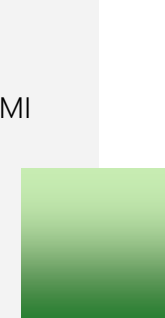
A ground source (geothermal) heat pump option was explored to compare the costs and benefits.

EXPAND TO COOLING

Replacements for the existing cooling units will connect to the heat pump's chilled water. Removing condensing units from the building exterior.

ELECTRIFY APPLIANCES

The cooking appliances and laundry dryers will be replaced, when needed, with all-electric models.



ELECTRIFICATION TIMELINE

Tri Delta Iota House

718 Tappan Ave., Ann Arbor, MI

1 Weatherization & Ventilation

Survey Leaks, Design Ventilation
Winter 2023

Seal Crawl Spaces, Replace Basement
Windows, Install Ventilation System
Summer 2023

Air Sealing and Blower Door Testing
Summer 2023 or 2024

2 Heating Demand Monitoring

Test and Monitor Hot Water Use
Winter 2024 or 2025

5 House Director Suite

HVAC Upgrades
Summer 2025, 2026, or 2027

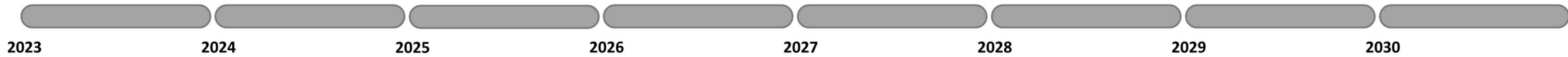
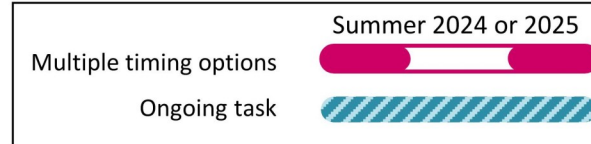
4 Hot Water Heat Pump

Electrify Water and Space Heating
Summer 2025, 2026, or 2027

7 Expand Chilled Water

Use chilled water instead of refrigerant based cooling
Ongoing After Hot Water Heat Pump Installation

Legend



3 Building Automation System

Install Integrated Building Controls
Summer 2023 - Ongoing

6 Replace Gas Appliances

With New Electric Models
Winter 2023 - Ongoing

