

SUSTAINABLE HVAC SYSTEMS IN U-M DORMS

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CENTRAL RESEARCH QUESTION:

How can UofM harness renewable energy to improve airflow and heating & cooling in Michigan dorms?



Supply Valve
(commonly, the Radiator Valve)



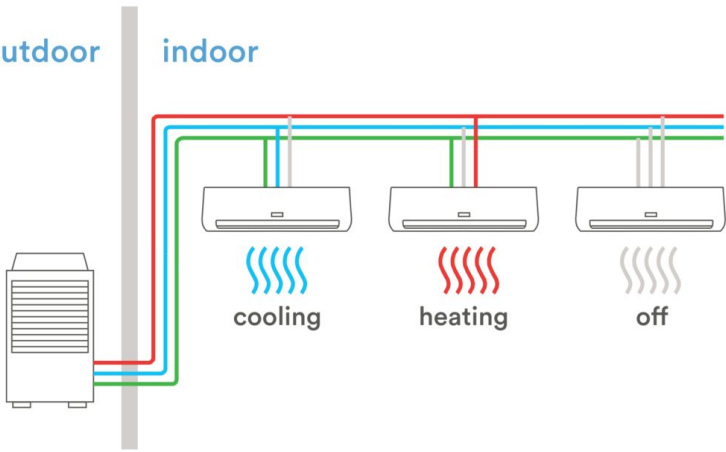
Vent Valve (or
commonly, the Air
Valve)

WHAT ARE HVACS?

- Heating, Ventilation, and Air Cooling
- Control building temperatures + fresh air circulation
- Used in homes and large buildings
- Originally created as steam ventilators
- Modern technology: Variant Refrigerant Flow Systems

outdoor

indoor



CURRENT POWER SOURCES AND THE MECHANICS OF HVACS

- Industrial-sized heating and cooling across residences
 - Through air system with filters
- Boiler systems and radiators at older residence halls
 - Bursley, Northwood
- Halls closer to Central Power Plant receive steam byproduct as heat source
 - South Quad, West Quad
- AC used through a cooling loop of chilled air, can control for humidity



ALTERNATIVE SUSTAINABLE ENERGY SOURCES FOR HVAC



GEO-EXCHANGE

Uses a heat pump to store and retrieve heat from the earth



SOLAR

Panels on residence buildings as an energy source for heating



WIND

Wind turns turbine blades around a rotor, which spins a generator

INTERVIEW: ALEX BRYAN, DIRECTOR OF STUDENT LIFE SUSTAINABILITY

- UM adequately maintains HVAC systems
 - Room for improvement
- Preventative maintenance occurs regularly
 - Filter replacement, sensor monitoring
- Partnership with DTE to streamline process

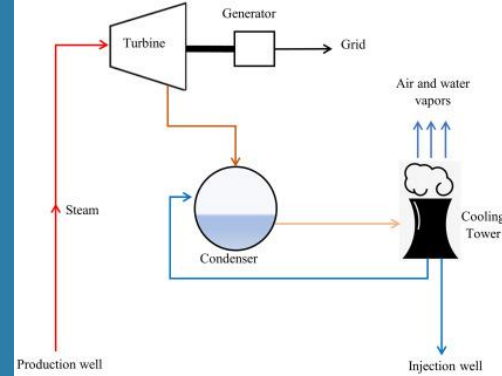


INTERVIEW CONT.

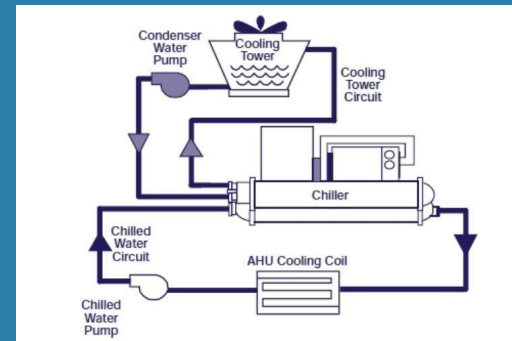
Primary energy sources:

- Central steam from power plant (1)
- Regional chiller plants to cool buildings
- Water-powered chiller systems (2)
- Natural gas boilers (3)

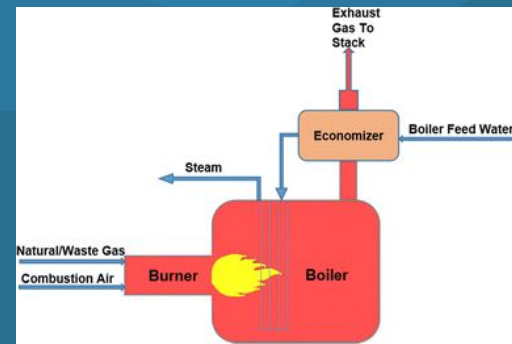
*not sustainable



1



2



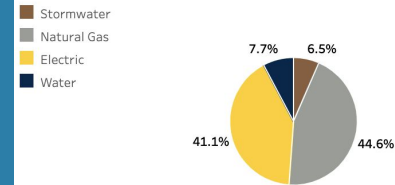
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OUR FINDINGS: WHAT NEEDS TO BE DONE

- **Vision:** decarbonize halls
 - Thermal efficiency + electrification
- **Challenge:** heating/cooling technology is complex
- Systems don't operate at low temp. → need back-ups
- Increases in cost + embedded carbon

Baits | Emissions and Utility Costs →

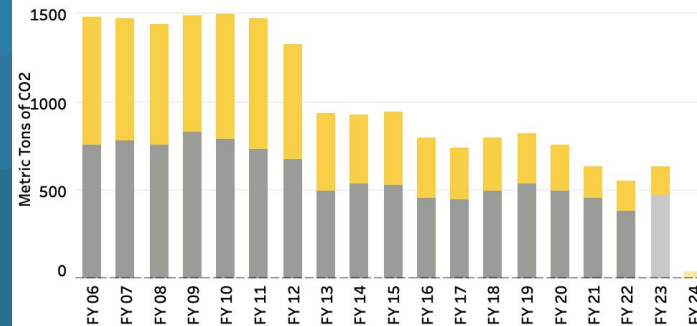
FY 23 Utility Costs by Type



Total Utility Costs = \$83,882

Total Utility Cost by FY

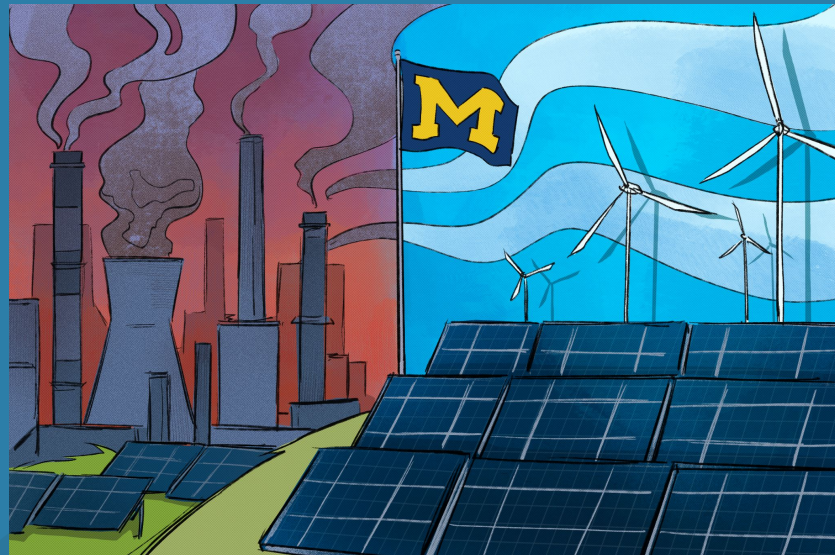
GHG Emissions



Metric Tons of CO2e

OUR FINDINGS: WHAT NEEDS TO BE DONE CONT.

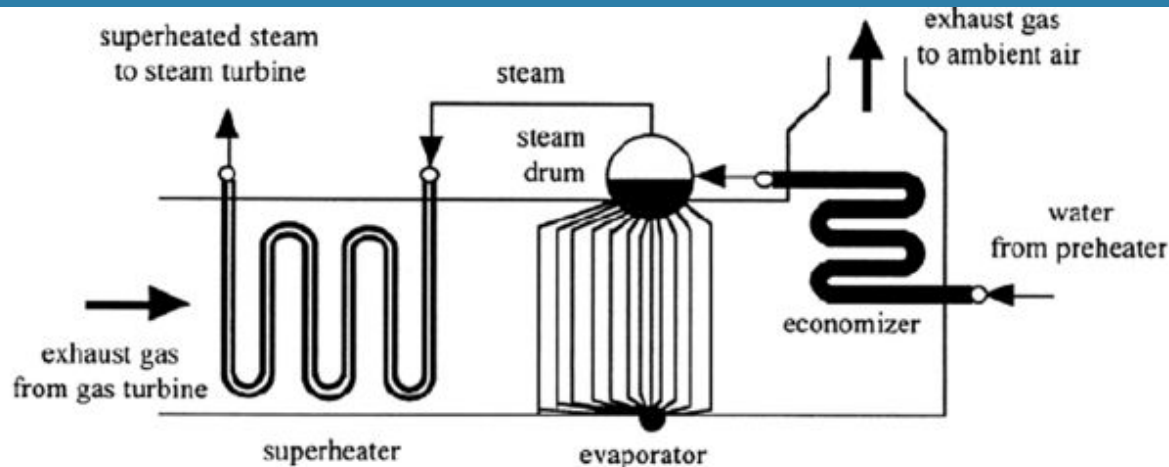
- Solar panels on roofing, steam-based heating
 - Eliminate natural gas
- Lack of space for equipment
 - Work with energy company to transfer to campus
- Removing carbon from electrical AND thermal generation
 - Converting electricity to heat is inefficient



OUR FINDINGS: WHAT NEEDS TO BE DONE CONT.

Main Goal: Alternative energy source for Central Power Plant

- Many halls rely on CPP for power
- Currently heat recovery steam generator system (HRSG)
 - Degradation risks: creep, thermal + mechanical fatigue, corrosion
- Shifting to renewables will address root issue



CAMPUS PLAN 2050: SUSTAINABILITY GOALS



01 RENOVATE BUILDINGS TO USE LESS ENERGY

- Exterior envelopes
- Building infrastructure



02 TRANSITION FROM FOSSIL FUELS TO ELECTRICITY

- Electrification
- Districts that connect overtime



03 GENERATE ELECTRICITY FROM RENEWABLES

- Photovoltaic panels
- Geo-exchange systems



04 CURRENT IMPLEMENTATION PLANS

- Geo-exchange for new + existing buildings

OUR ADVOCACY PROJECT: PRESENTING TO ADMINISTRATION

- Presenting to administration from Campus Plan 2050 & Carbon Neutrality Program
 - Early December, date tentative
- Emphasize transitioning CPP to renewable energy
- Encourage geo-exchange implementation in old halls
- Eliminate need for carbon-eating backup systems



**PRESIDENT'S
COMMISSION ON
CARBON NEUTRALITY**
UNIVERSITY OF MICHIGAN

**Blueprint for
Our Future**

The University of Michigan is embarking on an inclusive planning process to realize the future of the Ann Arbor physical campus — Campus Plan 2050. The active participation of University of Michigan students, faculty, staff, alumni and partners will be vital to the success of the process.

M CAMPUS PLAN 2050
UNIVERSITY OF MICHIGAN

Share Your Ideas

The image shows a presentation slide with a background photograph of a large, multi-story brick building with classical architectural features like columns. The slide has a dark blue header and footer. The main text is in white and yellow. A yellow button with the text 'Share Your Ideas' is located at the bottom center.



THANK YOU.

ANY QUESTIONS?