Climate Action Plan & Thermal Systems Task Force

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Fall 2023 Project Update

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Forum Agenda

- Thermal Systems Task Force Overview, Work to date, and Process
- Background Information:
  - Energy and GHG Usage on Campus
  - Climate Action Plan Successes
- Heating System Options
  - Initial (2022) Report
  - New Information
- Evaluation Principles & Ways to Engage

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Thermal Taskforce

Work to Date & Process Forward

Thermal Systems Task Force

- Task Force Membership: Board members, faculty, students, staff

- Task Force Charter:
  - **REVIEW technical reports**, energy markets/regulations and complete due diligence on a potential thermal system transition

  - **ENGAGE the campus community** on available options and incorporate feedback

  - **RECOMMEND to the president** a long-term plan to support the recapitalization of the UO's campus heating infrastructure, balancing the following goals:
    - reduction of greenhouse gas emissions,
    - resiliency of campus heat production to energy markets and natural hazards,
    - limited disruption to student's campus experience, and
    - appropriate fiscal stewardship.

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Thermal Systems Task Force Timeline

Fall 2022	- Task Force review phase I heating study, UO emissions, set workplan - Commission phase II technical analysis
Winter 2023	- Task Force review existing infrastructure, regulatory and market issues
Spring 2023	- Community outreach and campus forums - Task Force reviews campus feedback
Summer 2023	- Analyze input costs, develop carbon intensity factors - Work closely with consulting engineers
Fall 2023	- Receive Concept Design for water-based distribution system - Begin Fall Term engagement with campus community - Complete emissions reduction estimates, financial analysis and due diligence process
Winter 2024	- Present findings to campus community - Review campus input and develop recommendation(s) to President - Submit report to President and present to Board of Trustees
Spring 2024	- Launch CAP 3

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Summer Work

UO staff and Burns & McDonnell consultants:

- Worked closely with consulting engineers on Conceptual Design for Options 3 and 4
- Evaluated existing building systems
- Developed anticipated phasing timelines and evaluated tunnel routes across campus

Thermal Taskforce:

- Established gas and electric price estimates and carbon intensity factors
- Developed evaluation principles
- Briefed the new president

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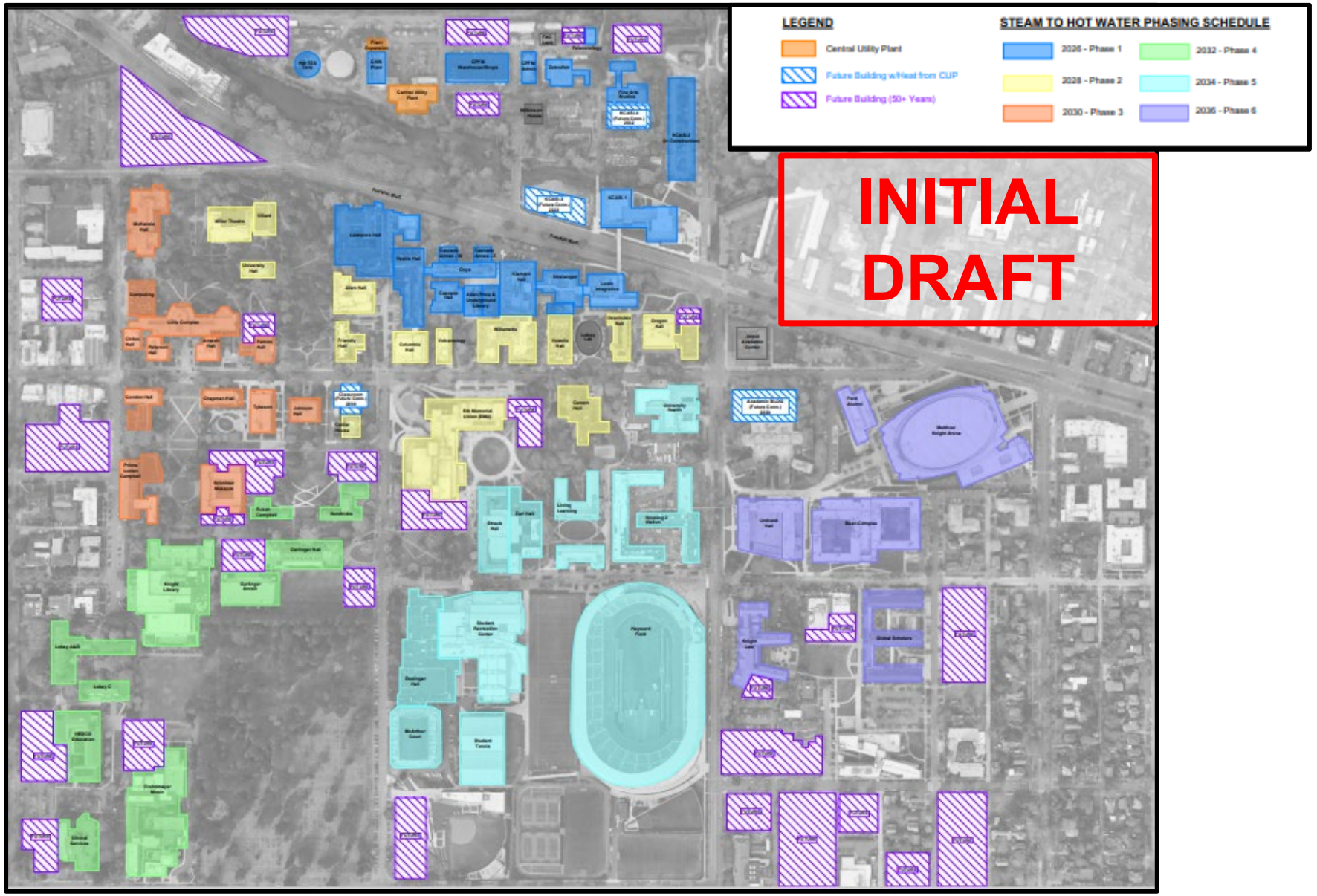
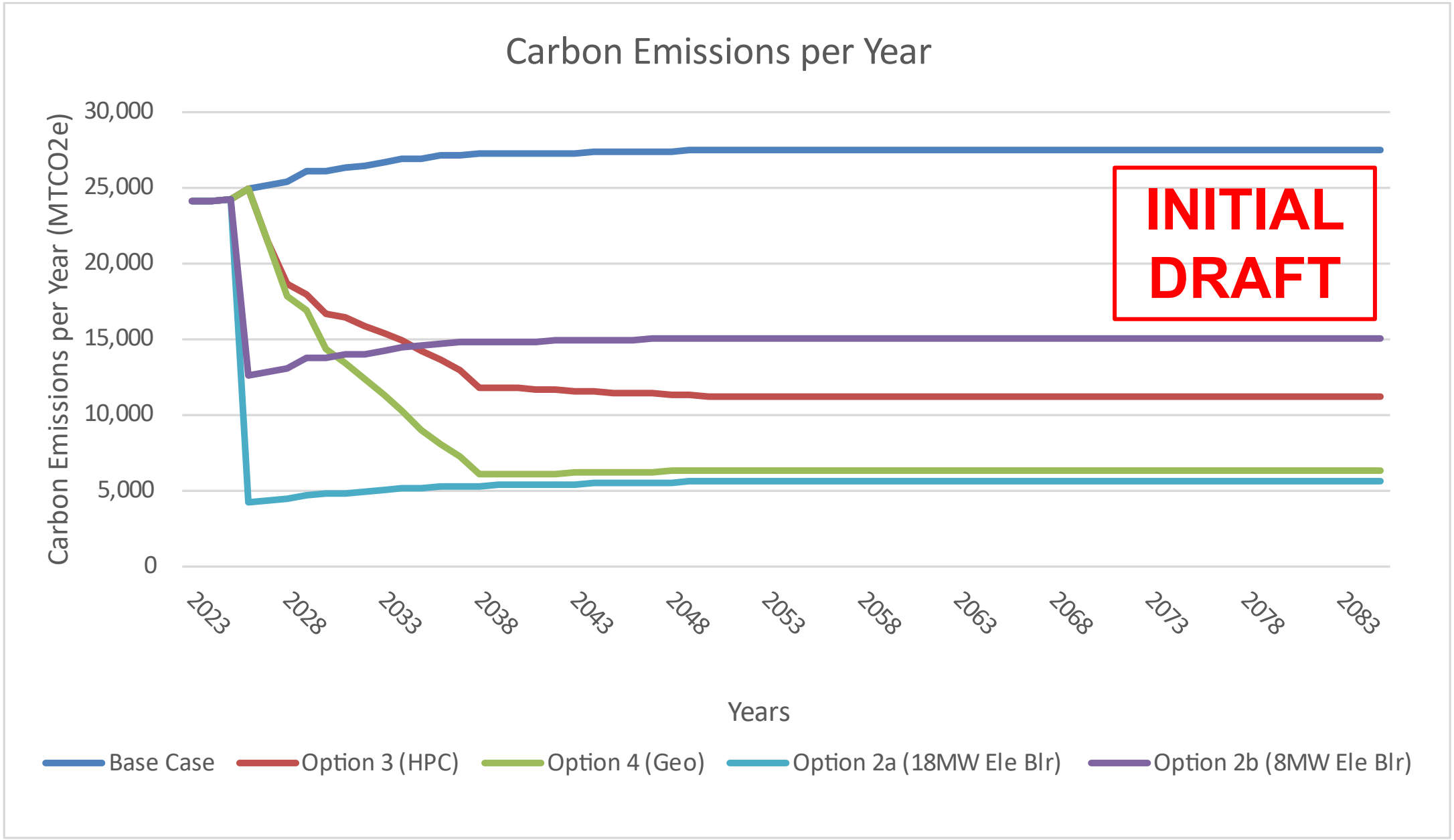
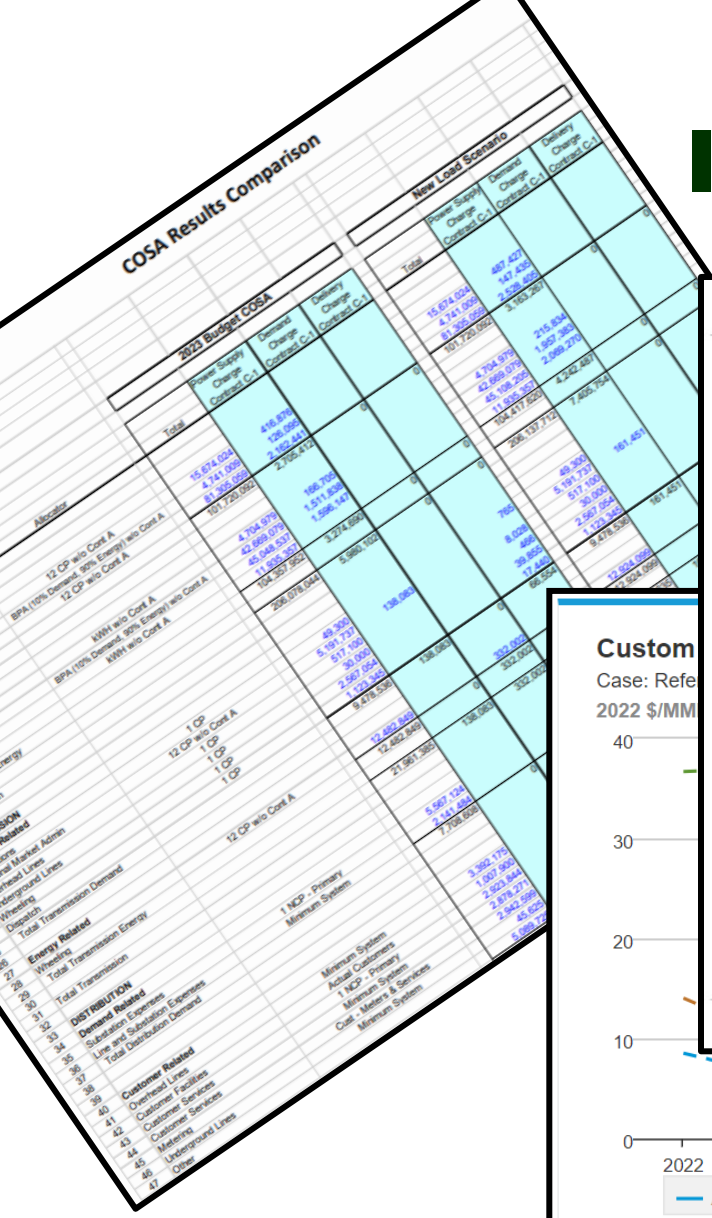
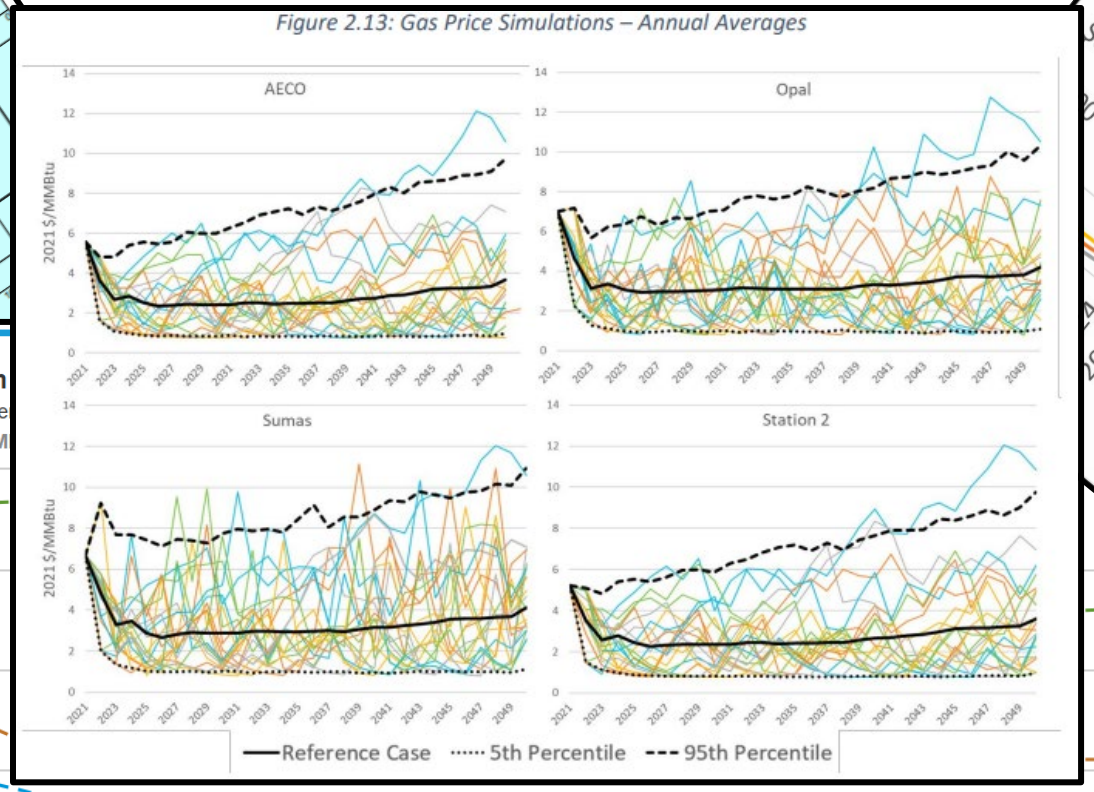
DRAFT Steam-to-Water Phasing

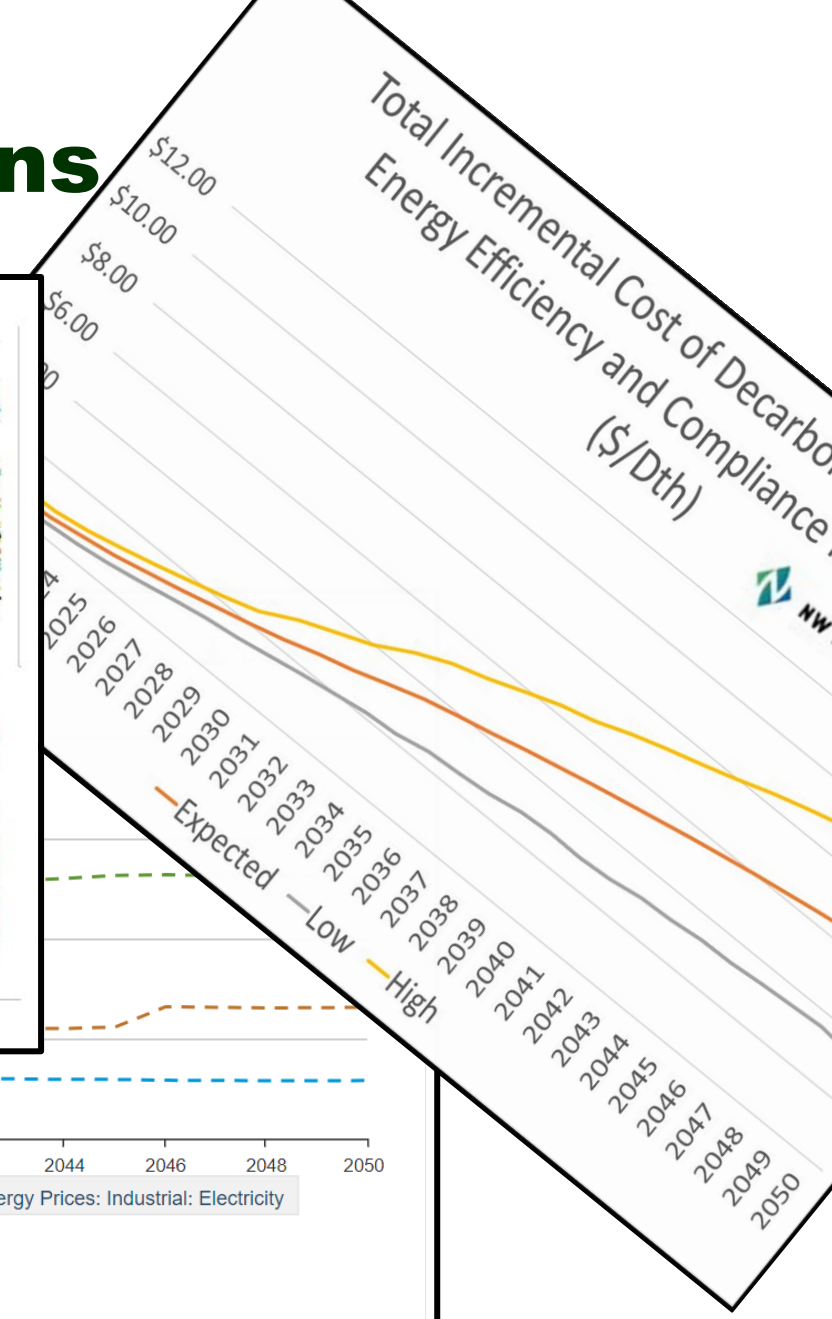



Carbon Emissions per Year
Carbon Emissions per Year (MTCO2e)
30,000
25,000
20,000
15,000
10,000
5,000
0
2023
2028
2033
2038
2043
2048
2053
2058
2063
2068
2073
2078
2083
Years
INITIAL DRAFT
Base Case
Option 3 (HPC)
Option 4 (Geo)
Option 2a (18MW Ele Blr)
Option 2b (8MW Ele Blr)

Input Price Assumptions







What to Expect During the Fall Term

- Reviewing preliminary/draft results & weighing alternatives
- Add Option 2B (8 MW electric boiler)
- **Receive final report in late November**
- Brief academic and administrative stakeholders and collect feedback
- Finalize input (electricity, natural gas, discount rates, etc.) price assumptions
- Develop draft findings for campus stakeholder feedback during Winter Term

What to Expect During the Winter Term

- Host campus forums to share Conceptual Design study results and Taskforce draft findings
- Evaluate campus stakeholder feedback
- **Develop and issue a Final recommendation to the President**
- Report to the Board of Trustees on Taskforce findings

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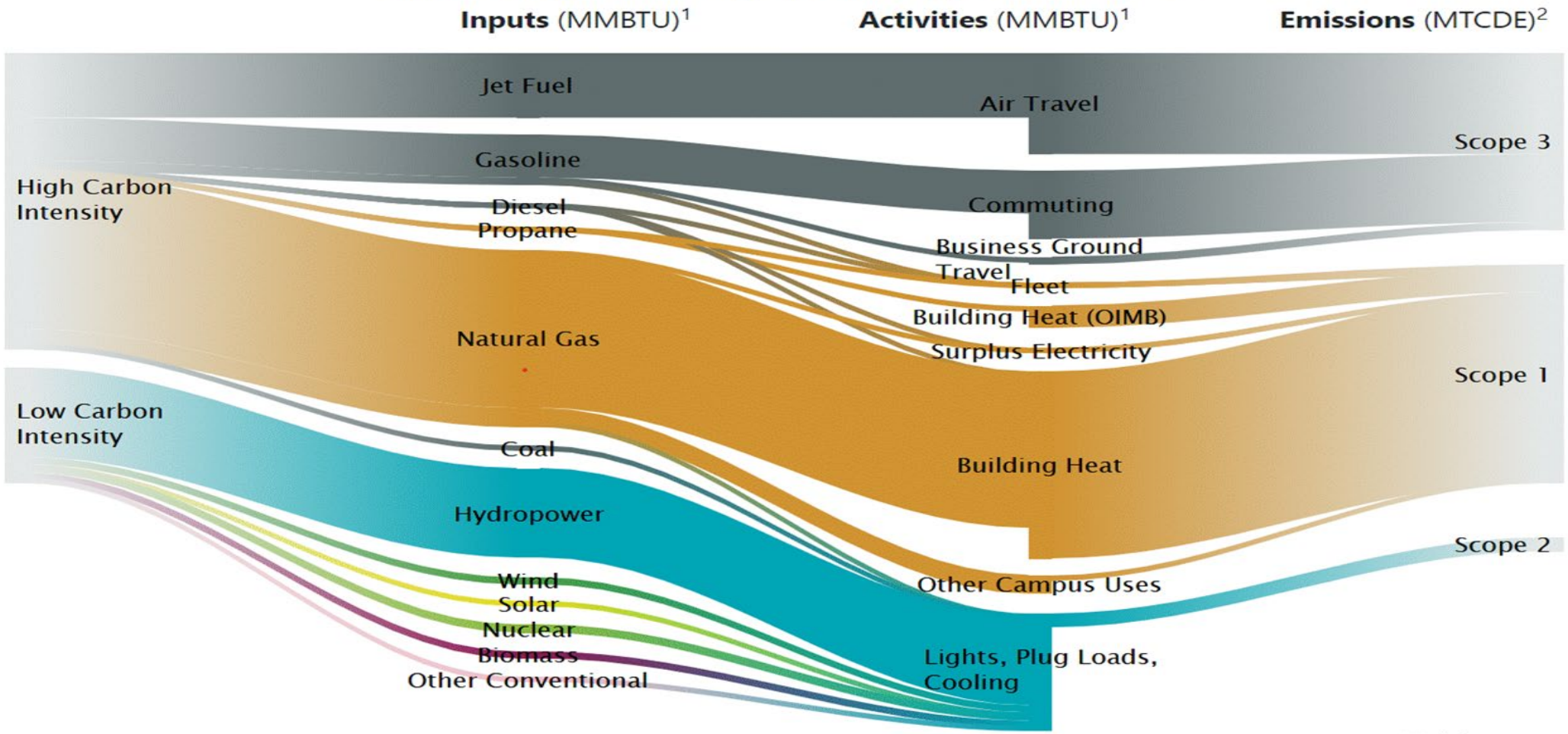
Background Information

Energy & GHG Usage
Climate Action Plans

University of Oregon Energy Flow FY20



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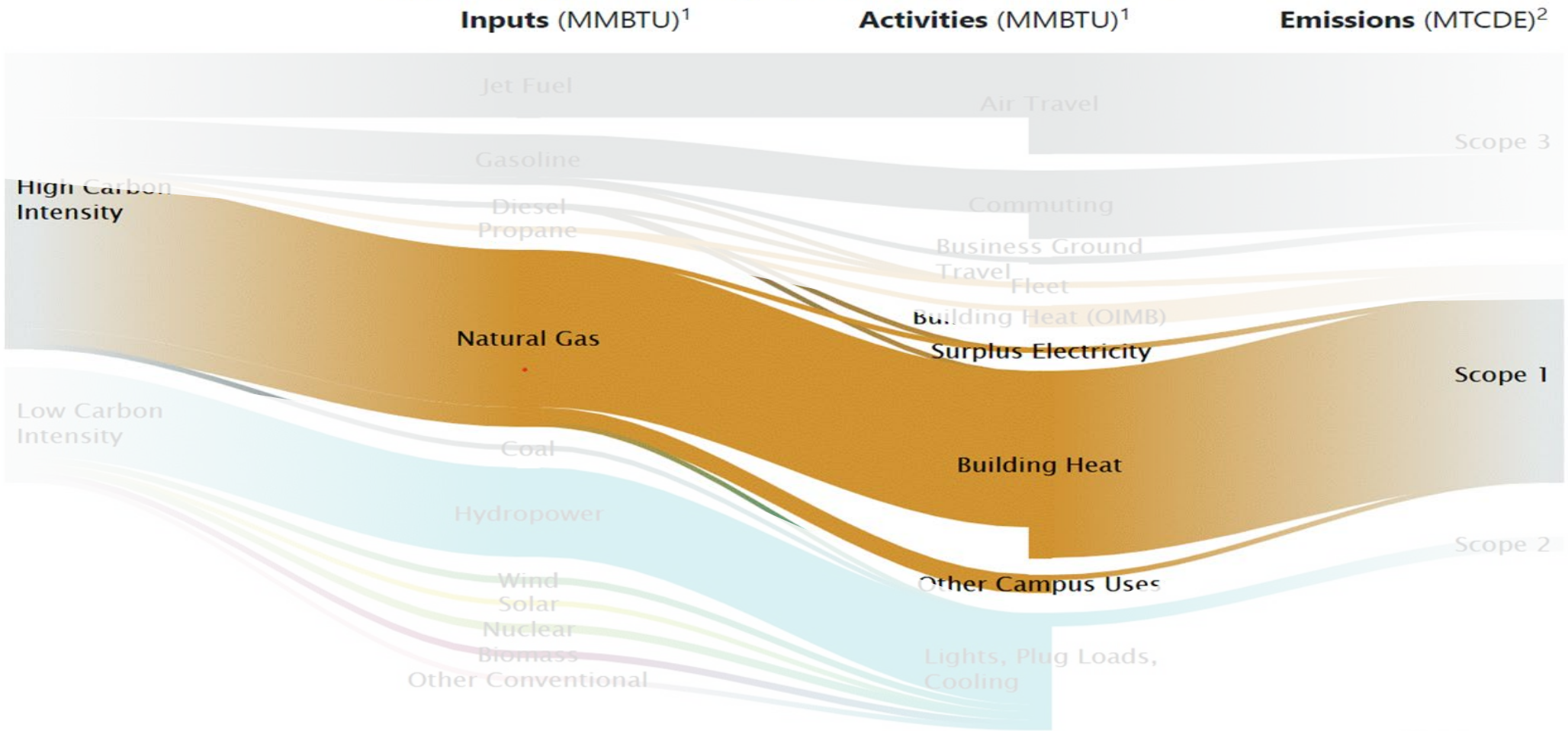
University of Oregon Energy Flow FY20



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Pre CAP and CAP 1 Focus Areas

Pre-CAP (2000-2010)

CAP 1 (2011-2019): Oregon Model for Sustainable Development

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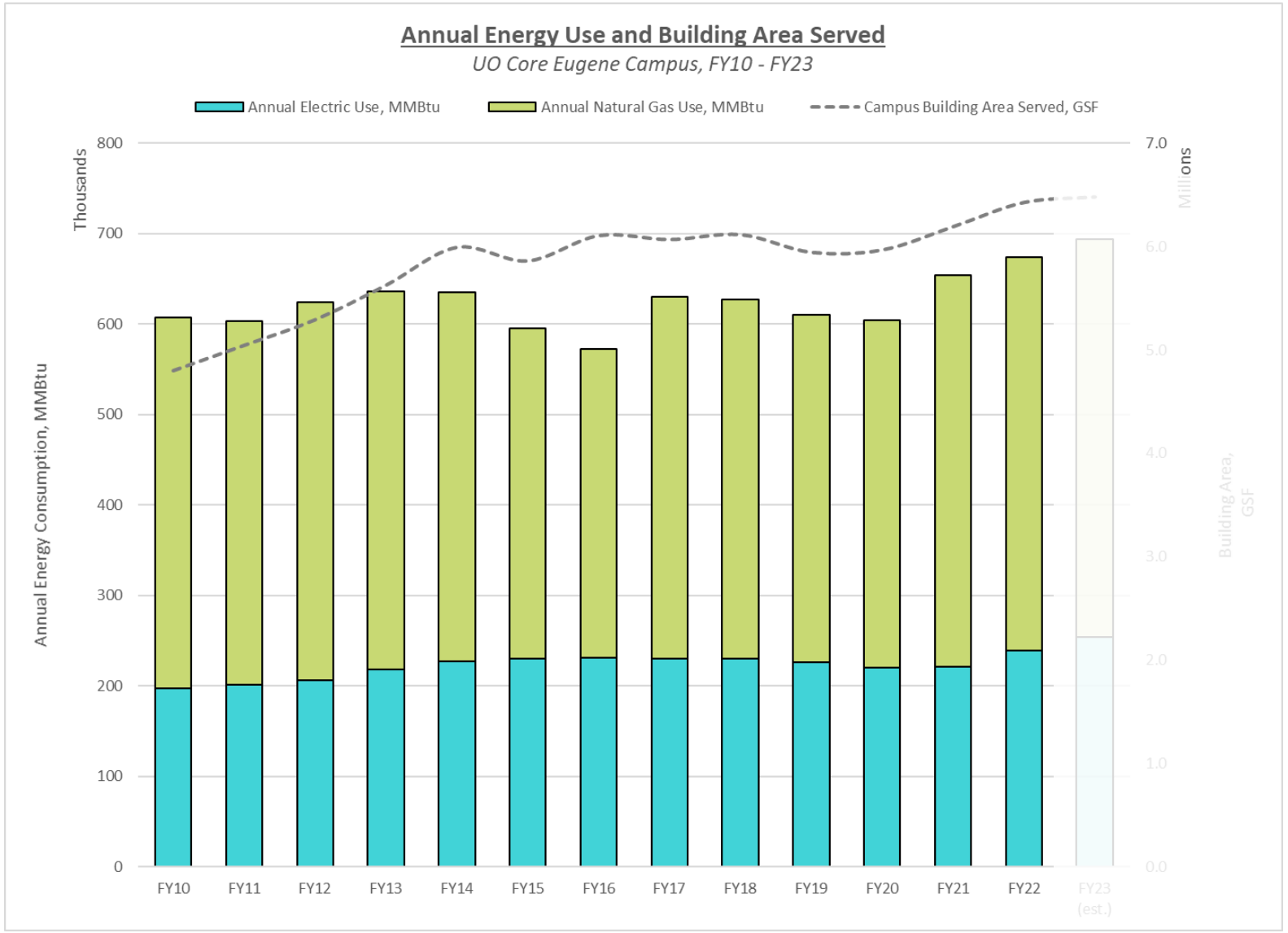
Results

Success!

Campus energy consumption from 2011 – 2019 did not increase despite significant growth in building square footage



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Climate Action Plan (CAP) 2019-2024

ACTION	STATUS
GOVERNANCE: Establish CAP Advisory Group	COMPLETE
GOVERNANCE: Update Board Of Trustees Annually	ON-GOING
MONITORING: Conduct Annual Emissions Inventory	ON-GOING
REVIEW & UPDATE: Oregon Model For Sustainable Development	COMPLETE
CONSERVATION & EFFICIENCY: Replace Tunnel Steam Pipe Insulation	COMPLETE
CONSERVATION & EFFICIENCY: Establish Energy Management Program	COMPLETE
CONSERVATION & EFFICIENCY: Re-launch Energy Revolving Fund	COMPLETE
CONSERVATION & EFFICIENCY: Launch Building Optimization Program	COMPLETE
STUDY: Internal Carbon Pricing	COMPLETE
STUDY: Low Carbon Heating Feasibility	IN PROGRESS
STUDY: Temperature Set Points	IN PROGRESS
STUDY: Winter Break Turn-Down Program	NOT STARTED
STUDY: LED Retrofit	NOT STARTED
STUDY: Sustainability Transportation Options	COMPLETE
STUDY: District Heating And Cooling Efficiency Improvements	IN PROGRESS
STUDY: Integration with State Carbon Policy	IN PROGRESS

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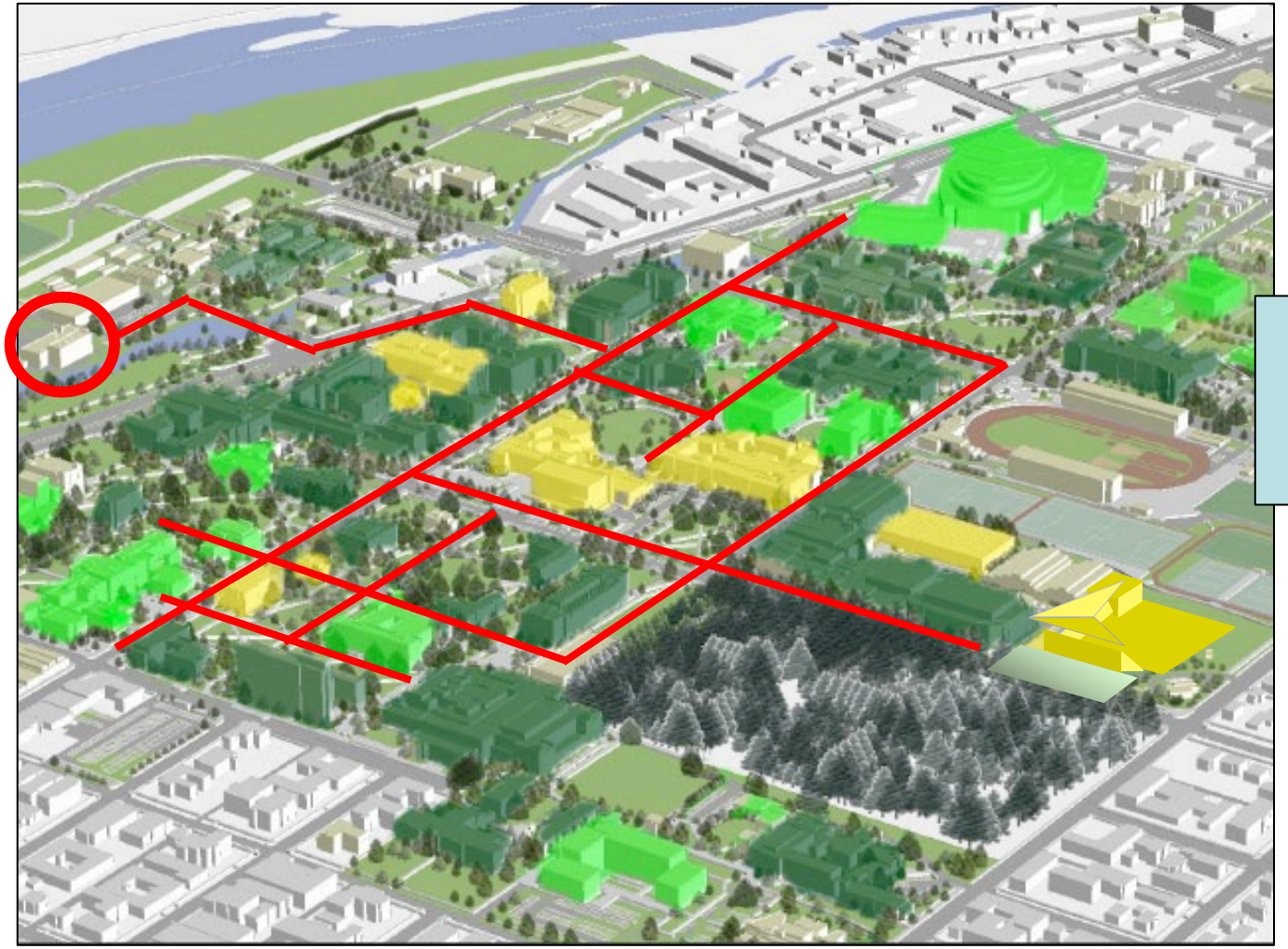
CAP 2 Focus Areas

Central Boilers
(Heat Source)



Steam Tunnels
(Distribution
System)

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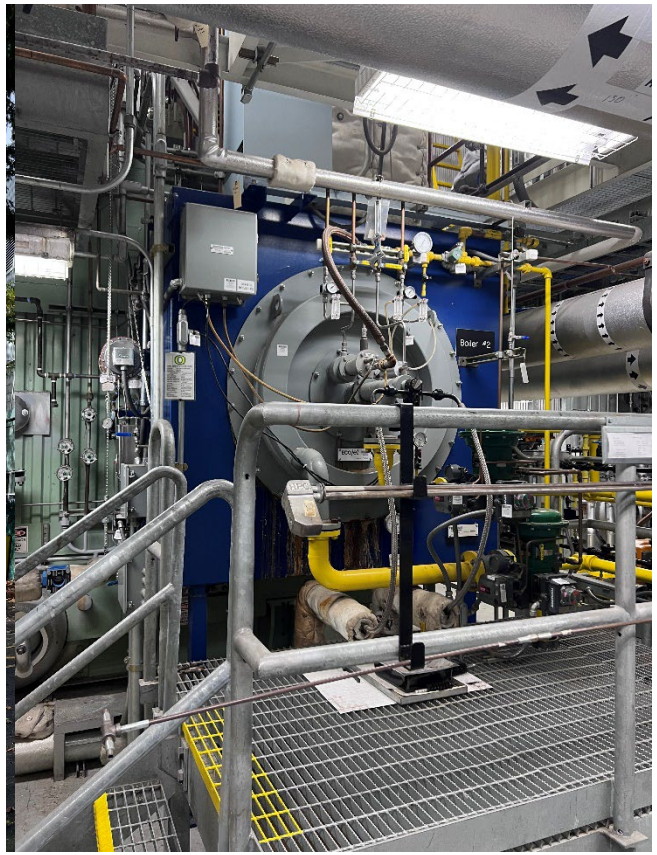
UO District Heating System

Central Boilers



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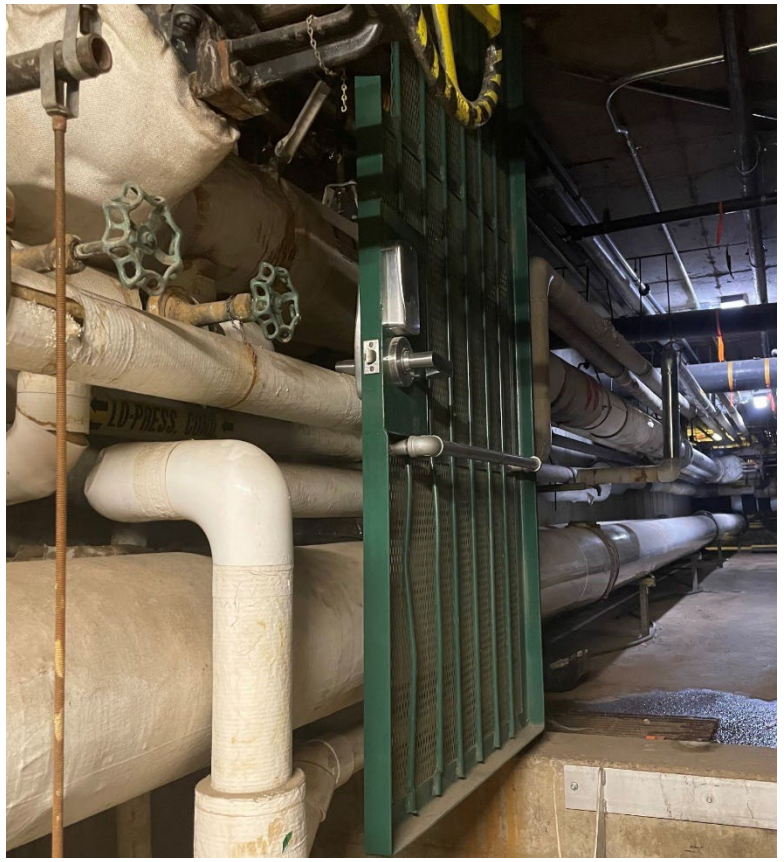
Steam Tunnels



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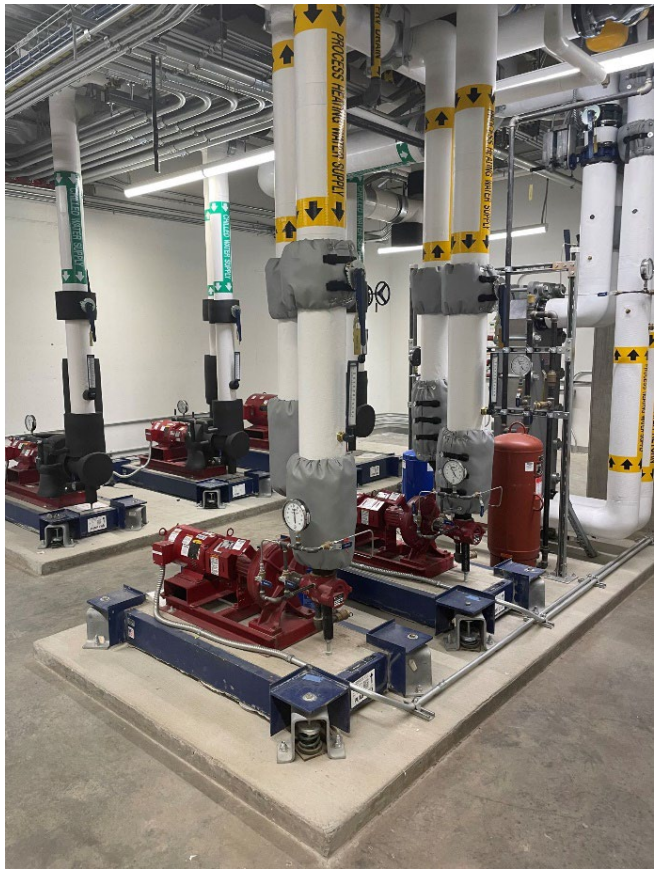
Building Heat Systems

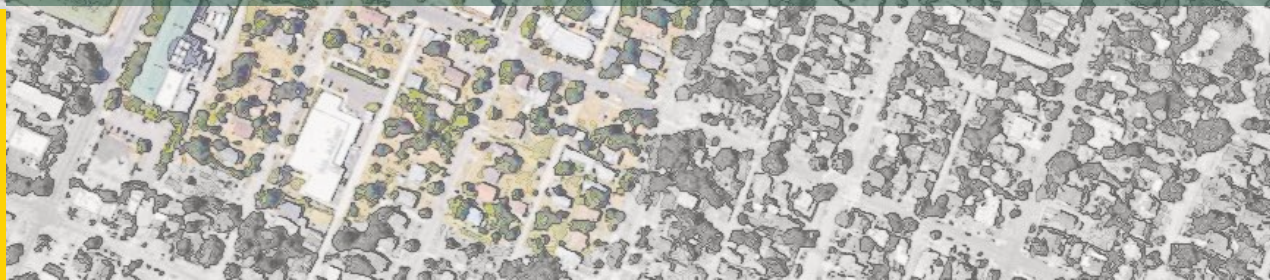


Heating System Options

Initial Report
New Information

University of Oregon
Thermal Systems Transition Study

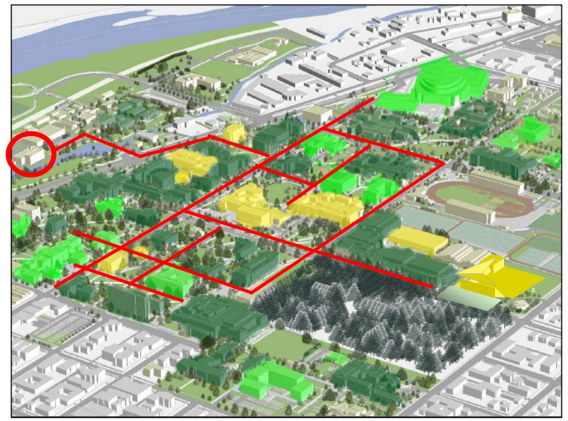
Affiliated Engineers



TASK FORCE WORKSHOP
February 3, 2023

AEI Options

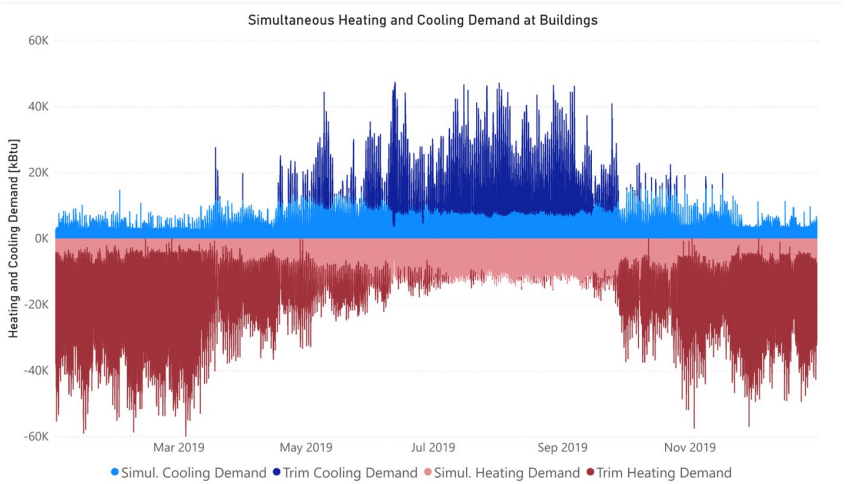
(1): SYSTEMS AS USUAL



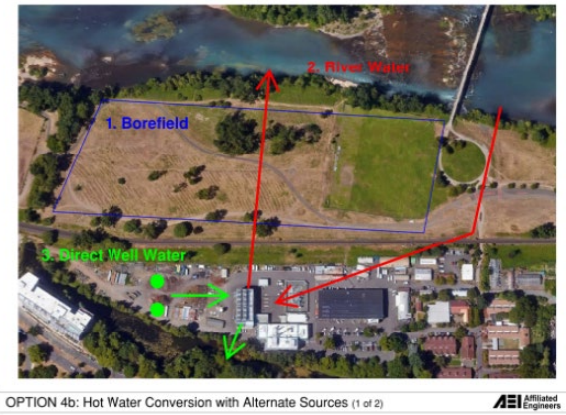
(2): ELECTRODE BOILER

Figure 2 - Cleaver Brooks 18 CEJS Electrode Boiler

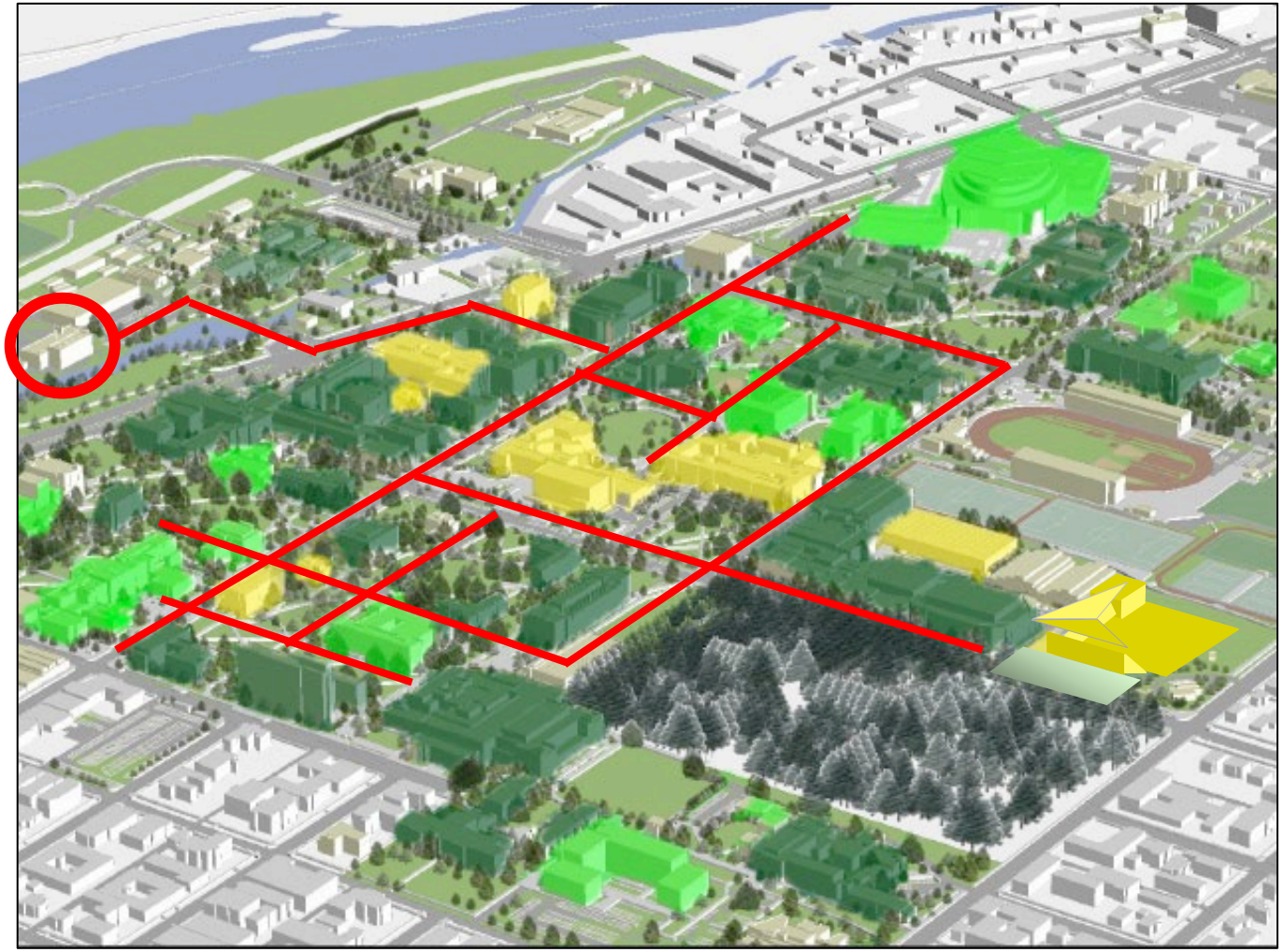
(3): HEAT RECOVERY CHILLER



(4): HEAT RECOVERY CHILLER ALTERNATE SOURCE



OPTION 1: SYSTEMS AS USUAL



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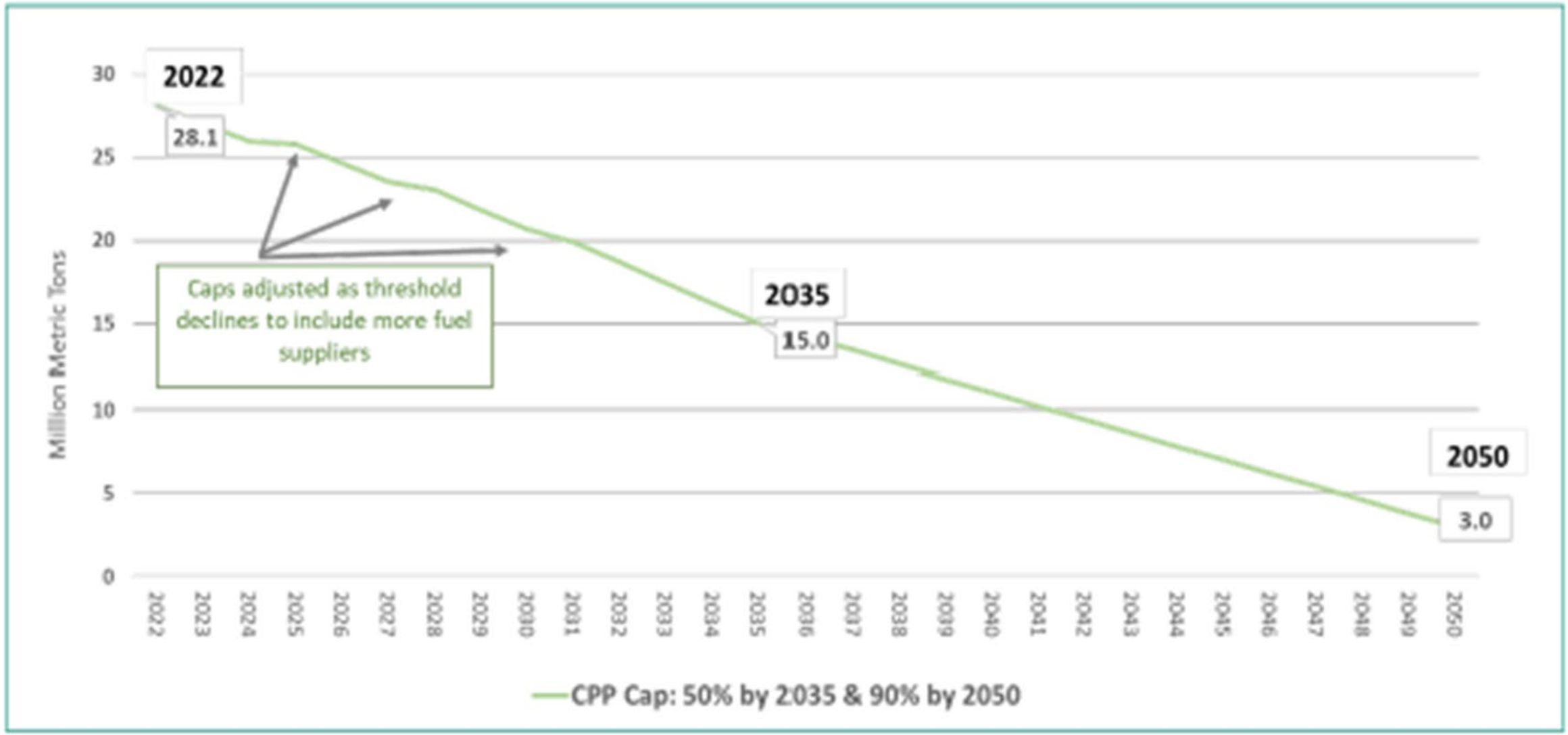
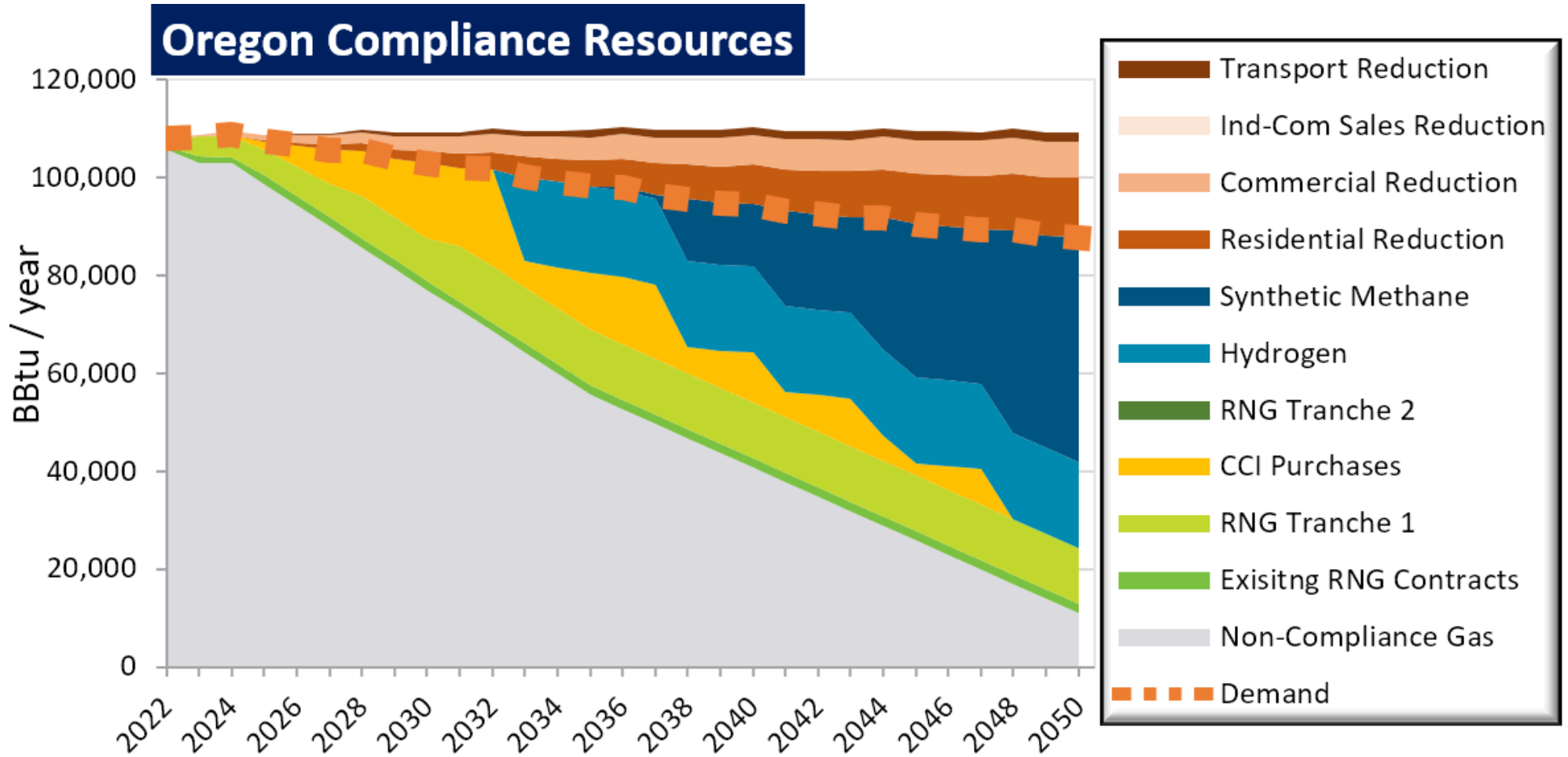
Oregon's Climate Protection Program (CPP)



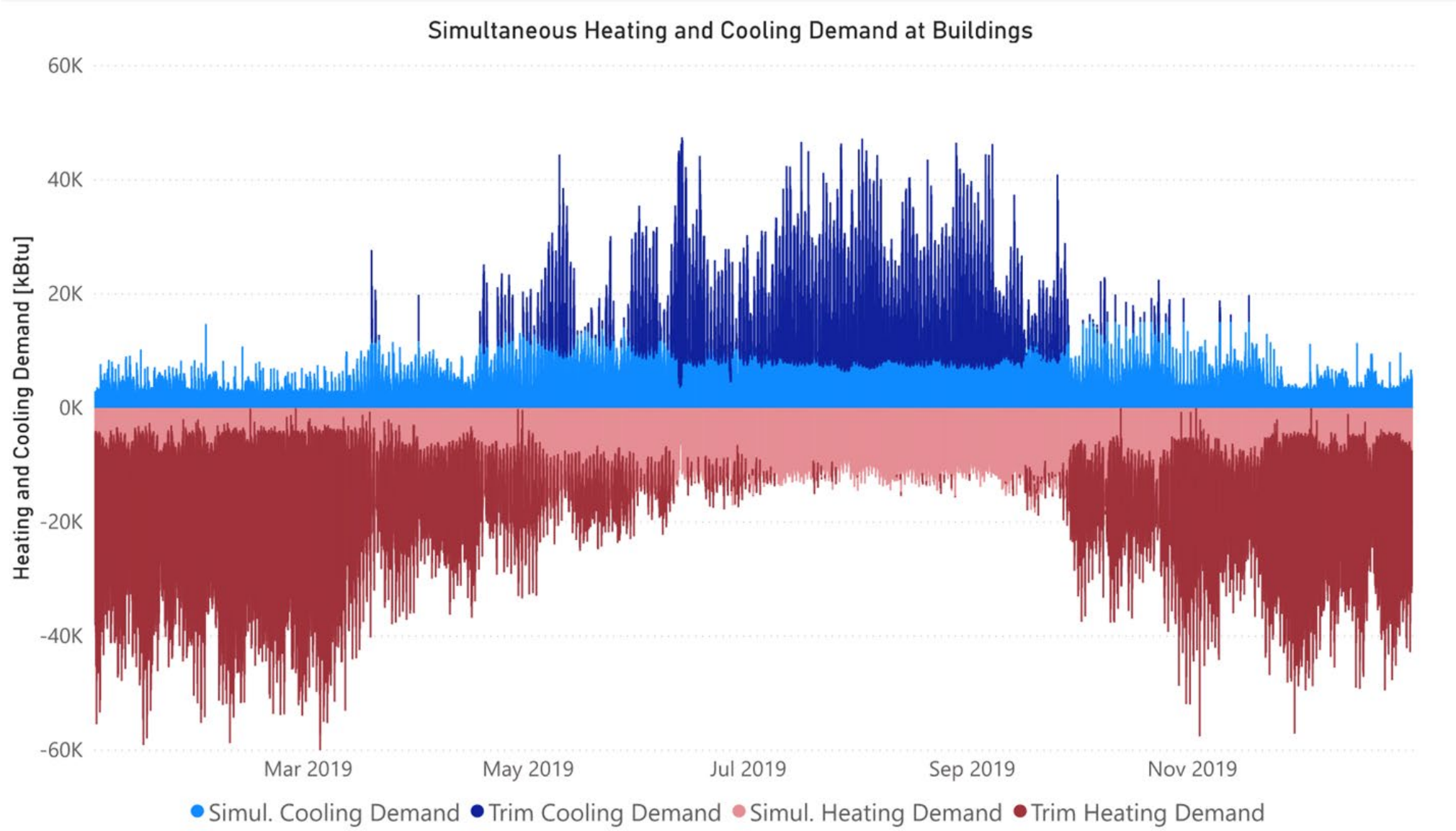
How do we plan to comply with CPP?



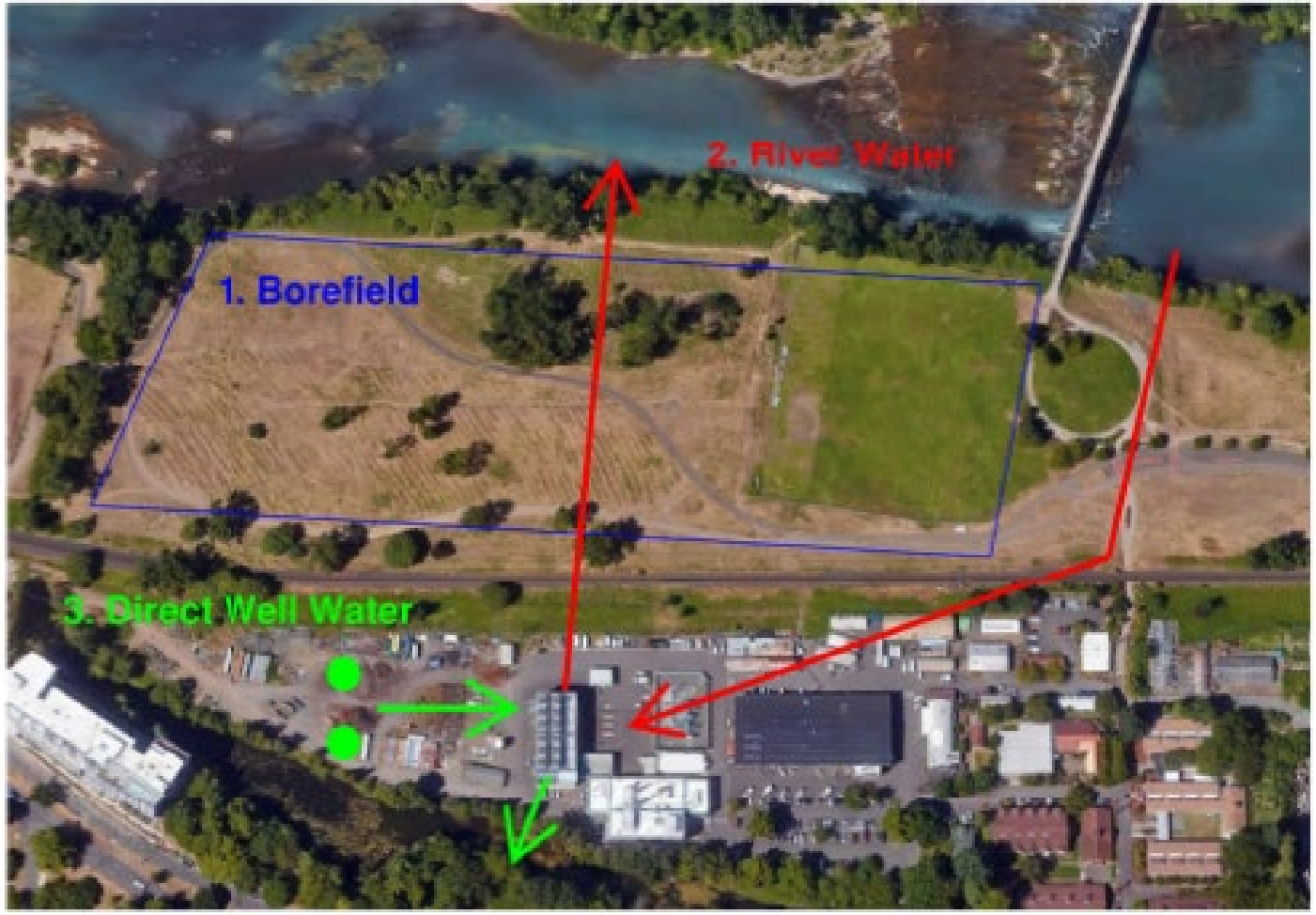
OPTION 2: ELECTRODE BOILER

Figure 2 - Cleaver Brooks 18 CEJS Electrode Boiler

OPTION 3: HEAT RECOVERY CHILLER WITH BUILDING SOURCE



OPTION 4: HEAT RECOVERY CHILLER WITH ALTERNATE SOURCE



OPTION 4b: Hot Water Conversion with Alternate Sources (1 of 2)

AEI Affiliated Engineers

What We Know Now

Option 1:

- Continuing to refine cost forecasts, including cost of maintaining existing steam heating infrastructure. Developing base case (no CPP) and case responsive to CPP.

Option 2 (18MW):

- Capital cost is significantly larger than originally anticipated due to electrical infrastructure upgrades necessary to support such large-scale electrification.
- Cost of electricity is likely to increase due to large new load and will increase operating costs substantially

Option 2b (8MW): *New*

- Consists of an 8MW electrode boiler which may reach as much as 50% GHG reduction in the shortest time possible
- Avoids significant electrical infrastructure upgrade, though increases operating costs
- Sets the university up for additional emissions reduction projects as technology develops

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What We Know Now

Option 3 & 4:

- **Building conversions** are likely to be a significant portion of the total cost of the project. These range from completely replacing internal steam heating systems throughout buildings to replacing only the heat exchangers.
- **IRA:** Inflation Reduction Act (IRA) *is* applicable at least for the thermal energy storage options and could range from ~20% to ~30% of the heat production/storage costs.
  - Option 3: ~1% savings from total project cost at this time
  - Option 4: ~6% savings from total project cost at this time
- **Construction disruption** - Phasing is expected to be over 6 two-year projects radiating from the powerplant south and east and would substantially impact all major buildings and most major thoroughfares.
- **Efficiency Improvements:** Ranging from approximately 50% to 65% improvement in total system efficiency.
- **Regulatory Issues:** Regulatory or waterflow issues will bar Willamette or Millrace use for heat exchange, thus focusing on geo-thermal bore-field (approx. 1,400 - 600 ft deep wells).

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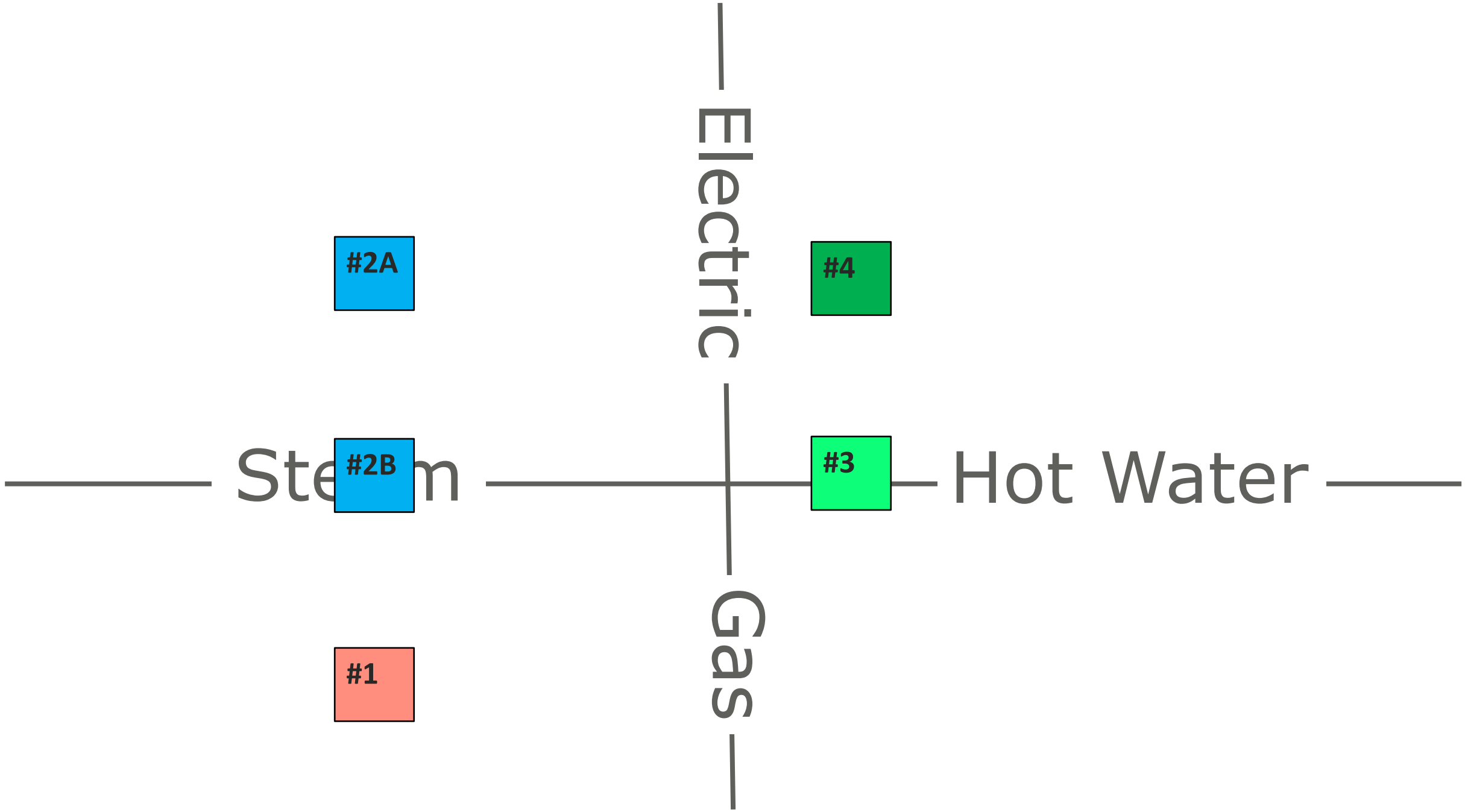
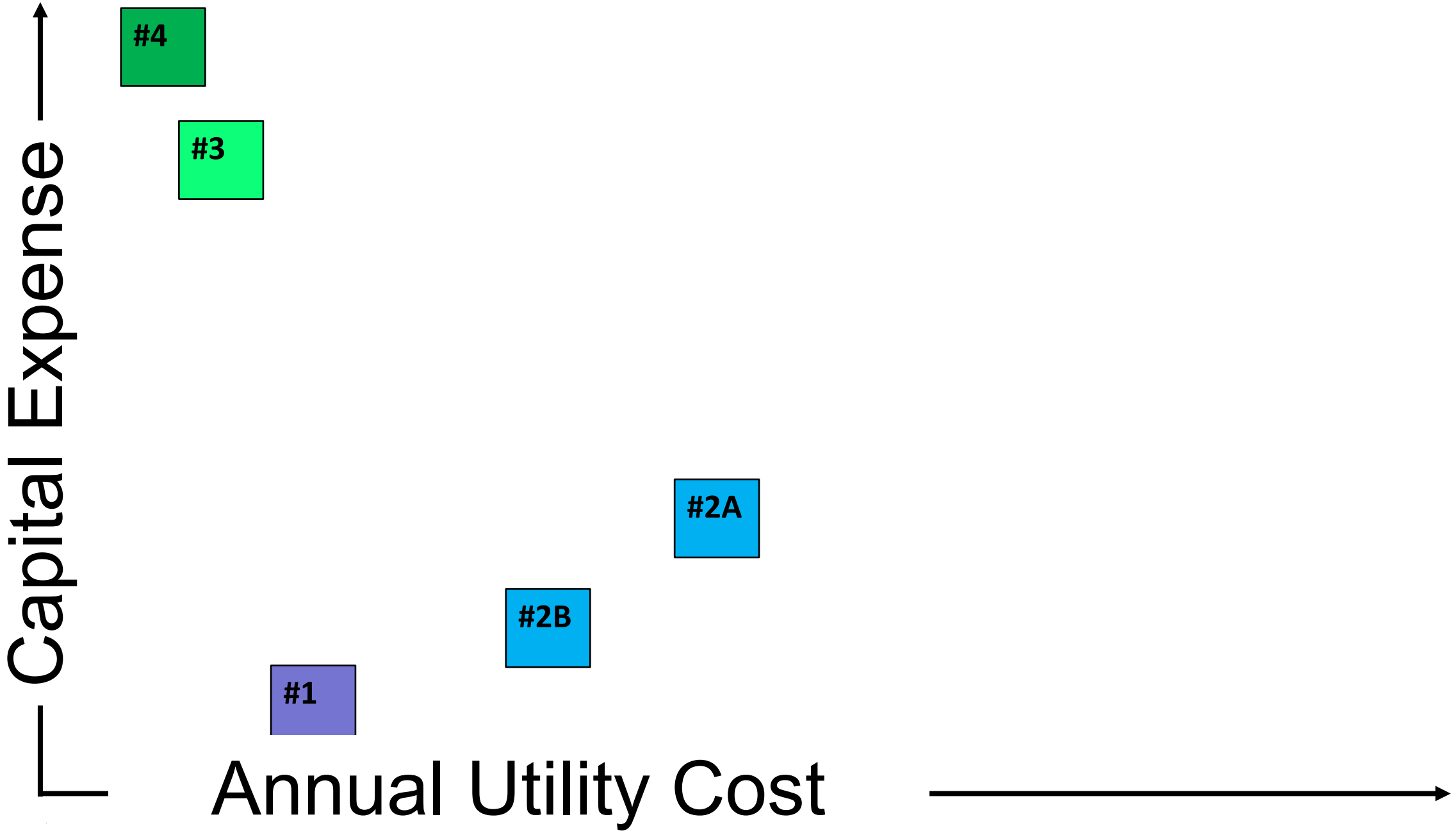
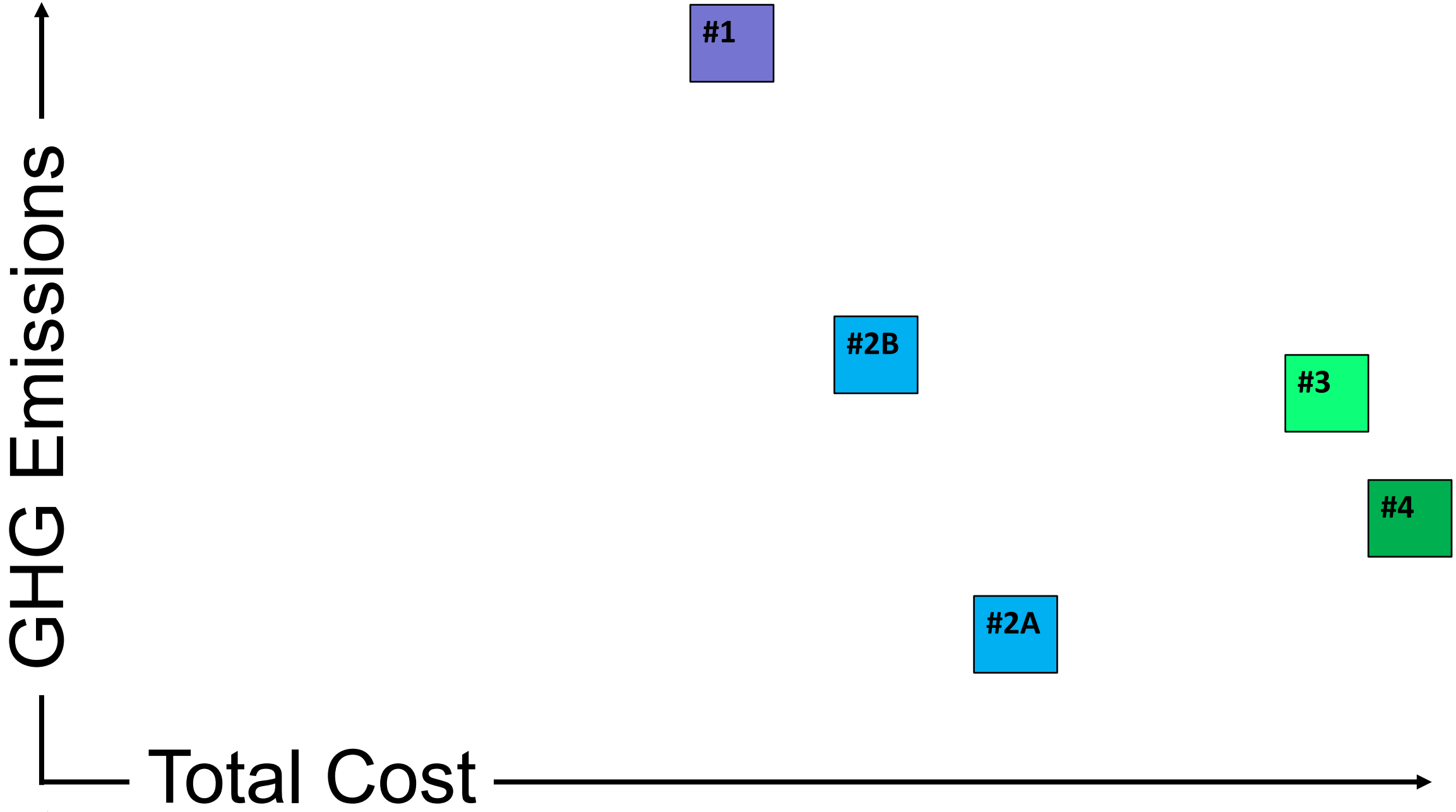

Electric
Steam
Hot Water
Gas
#2A
#4
#2B
#3
#1


Capital Expense
#4
#3
#2A
#2B
#1
Annual Utility Cost


GHG Emissions
Total Cost
#1
#2B
#3
#4
#2A

Evaluation Principles & Steps Forward

Evaluation Principles

- **Opportunity Cost**: recognizing the tradeoffs impacting the university of significant levels of new debt service.
- **Cost Impact to Students**: recognizing that maintaining affordability is important for social justice and economic mobility.
- **Regulatory and Price Risk**: recognizing that there are fast changing regulations and they may impact availability and pricing of utilities.
- **Control**: recognizing there is value in maintaining and asserting institutional control over our own destiny.
- **Campus Impact**: recognizing the importance of the on-campus experience for current and future students and continuity in the research enterprise at the university.
- **Resiliency**: recognizing the importance of maintaining a heating system that is resilient and reliable in the face of natural disaster and extreme weather.

Thermal Systems Task Force Timeline

Fall 2023	- Begin Fall Term engagement with campus community - Receive Concept Design for water-based distribution system - Complete carbon and financial analysis and due diligence process
Winter 2024	- Present findings to campus community - Review campus input and develop recommendation(s) to President - Submit report to President and present to Board of Trustees
Spring 2024	- Launch CAP 3

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Questions & Feedback

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