

LEADING THE WAY **CampusEnergy**2022

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Pathway to Carbon Mitigation: UMass Amherst Roadmap

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The Charge

I am asking the Task Force to study, or oversee a study, that would ask what it would take to get to 100% reliance on renewable energy sources for heating, cooling, and electricity usage on our campus by 2025, and alternatively by 2030.

– Chancellor Subbaswamy



The Task Force

Students

Faculty

Staff



Campus Energy System 101

Scale

280+ buildings that need heating, cooling and electricity

Demand

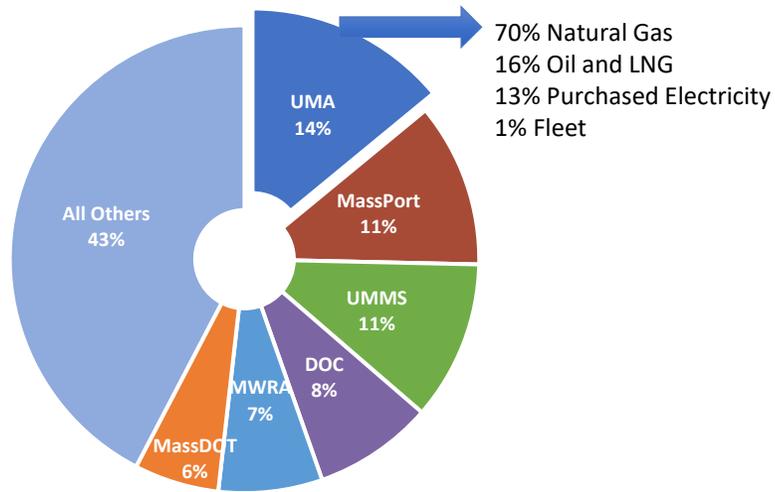
70% of energy is used to heat the campus with steam

To Date

Long history of providing reliable and efficient energy

UMA Emissions

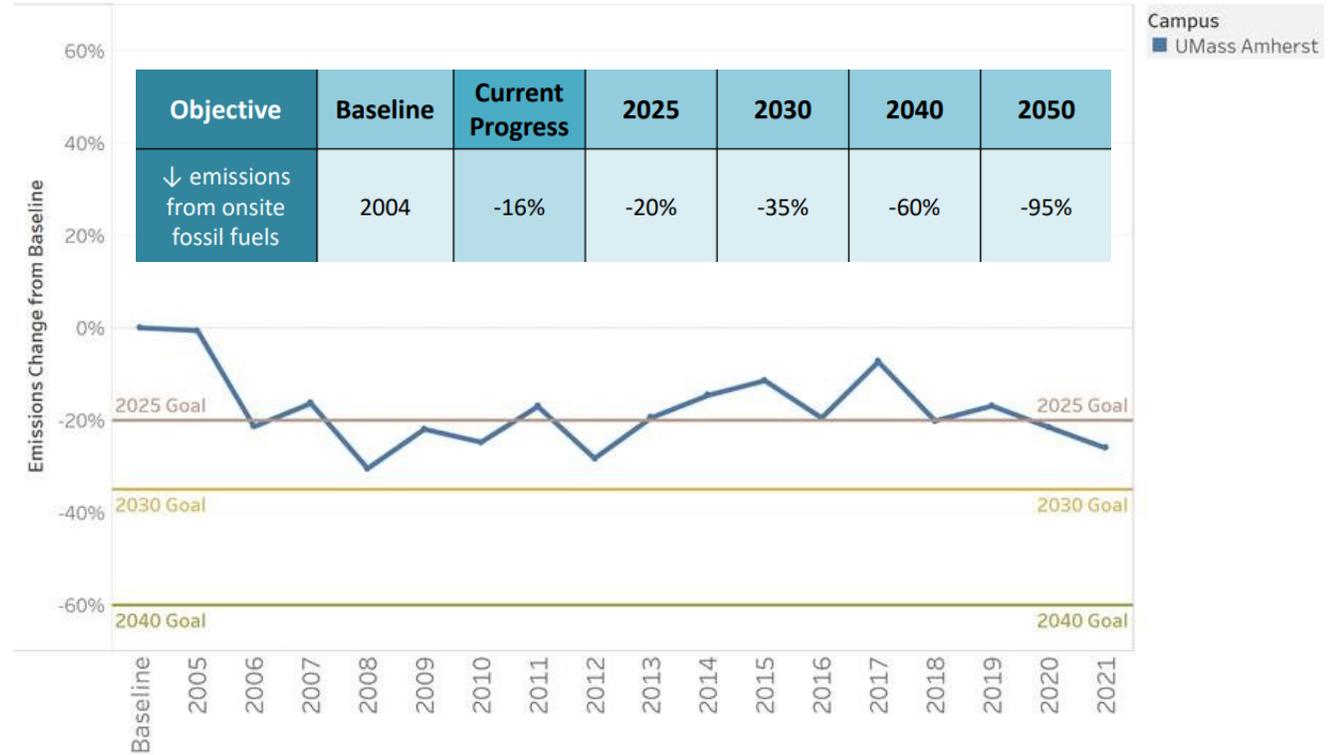
Statewide Emissions % Share and Dominant sources



% Contribution from Top 6 Emitters Compared to All Others in FY19

Hitting State Mandated Targets (EO 594)

Campus Emissions: Progress Towards EO594 Goals by Campus



UMass Amherst Energy Transitions Over Time



**First Steam Plant
(1910-1918)**



**Coal Plant
(1918-2008)**



**CHP Plant
(2009-present)**

Is it possible to get to 100% reliance on renewable energy sources?

2025	2030	2032
No	Maybe	Yes
The study finds that while theoretically possible, it would be impractical due to the scale of change required on campus.	The study shows that the campus can achieve more than 80% reductions by 2030, but final stages of transformation will still be underway.	The study shows that it is possible to implement and reach 100%, but only if we start now!

What will it take to get to 100% renewable energy?

1 Transition Away From Steam

Replace the campus circulatory heating system from inefficient steam to efficient low-temperature hot water.

2 Stop Burning Fossil Fuels

Leverage the low-temperature hot water system to avoid combustion. A modern system can trade and store energy using a variety of renewable thermal technologies.

3 Accelerate Energy Efficiency

Upgrade and renovate buildings to lower energy demand and make them compatible with low-temperature hot water.

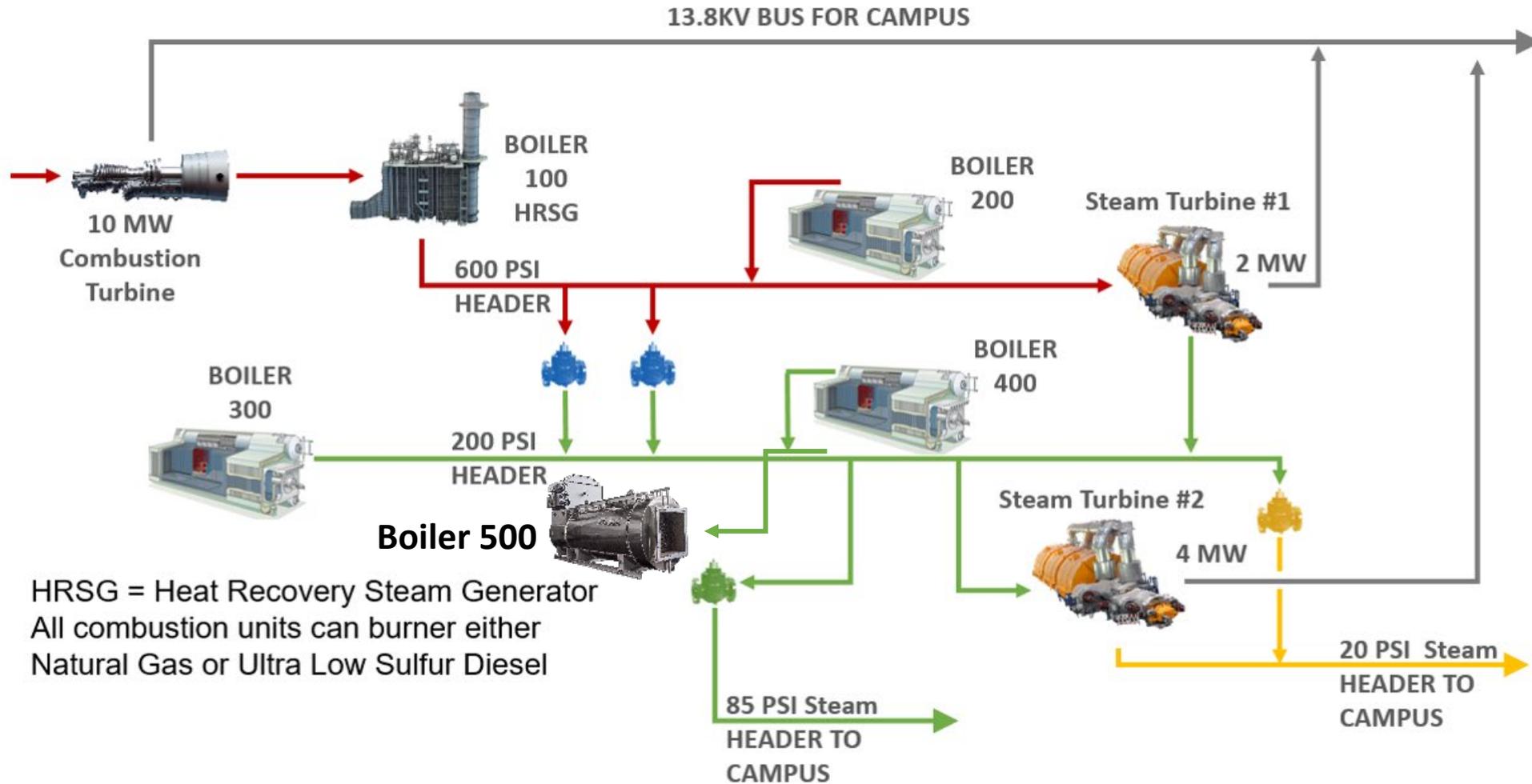
4 Expand the Use of Renewable Energy

Expand on-site solar, ground-source heating and cooling, and use more electricity from the rapidly greening grid.

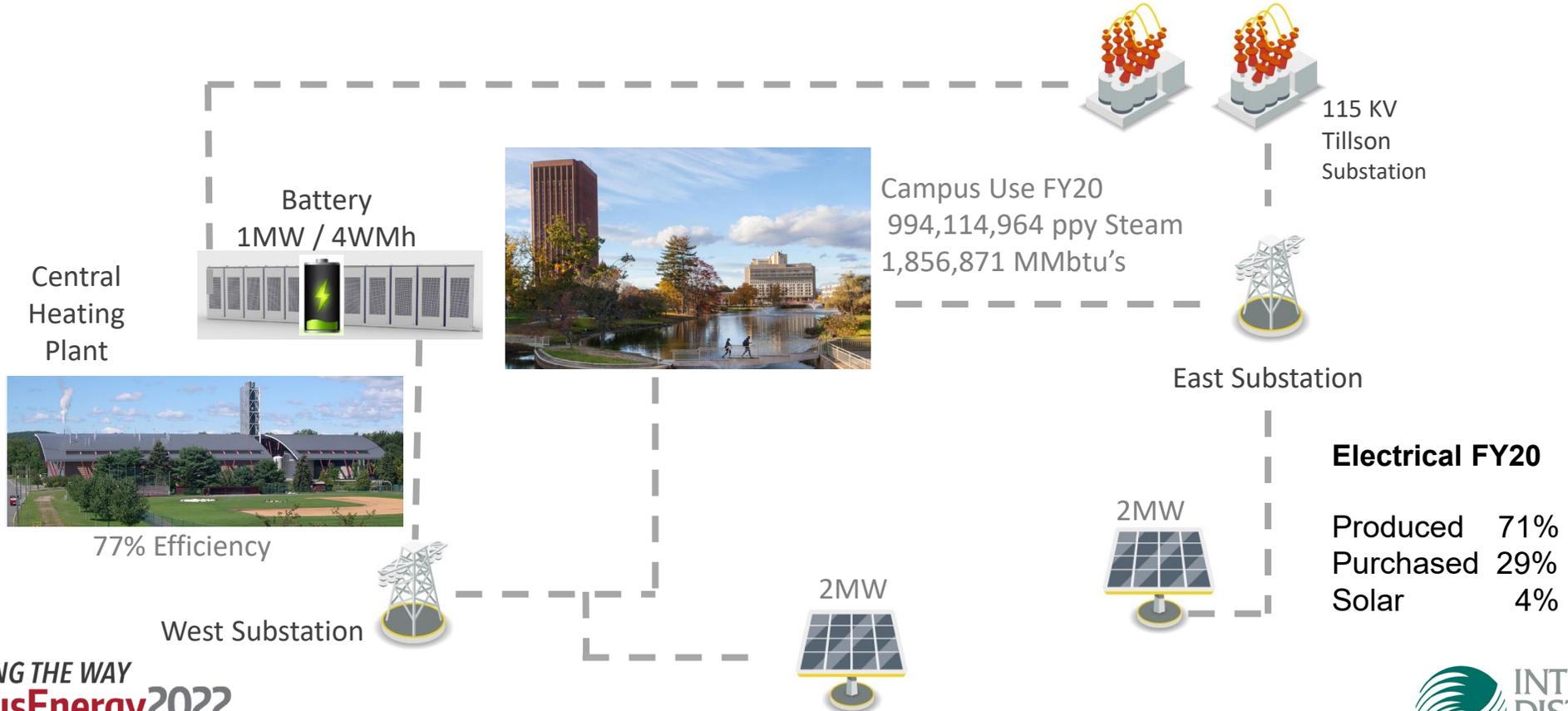
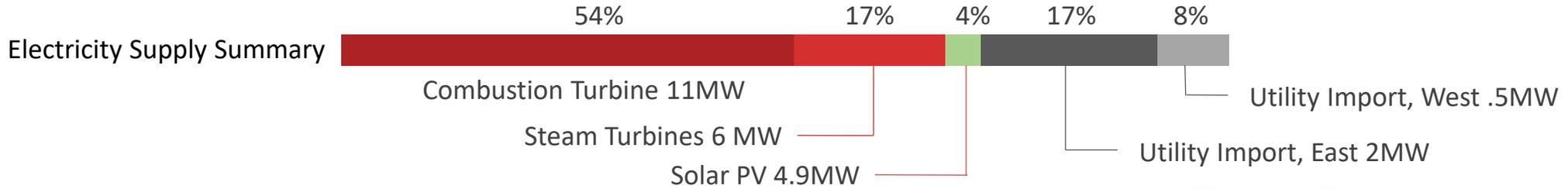
5 Integrate the Transition Into UMass Amherst Culture

The energy transition provides a once in a generation opportunity for research, education, and higher-ed leadership aligned with the strategic motto: "Be Revolutionary."

Inside the Central Heating Plant



Campus Utilities



Micro Grid

Benefits of Modernizing the District Energy System

Reduced Energy Use

Requires 65% less energy for a campus that is 10% larger.

Lower Operation Costs

The recommended upgrade will lower operational expenses by about 20%.

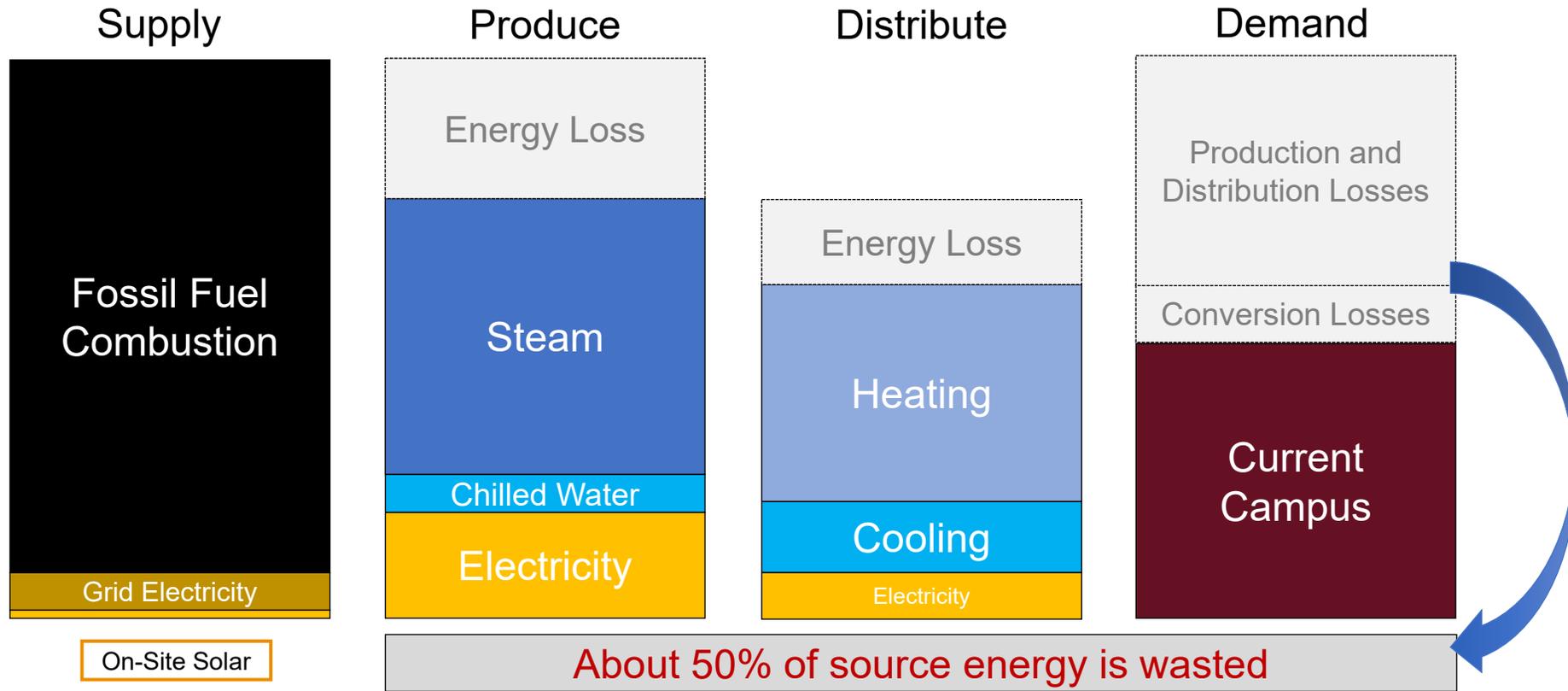
Improve Thermal Comfort

About 80% of the campus will have both heating and cooling in the buildings.

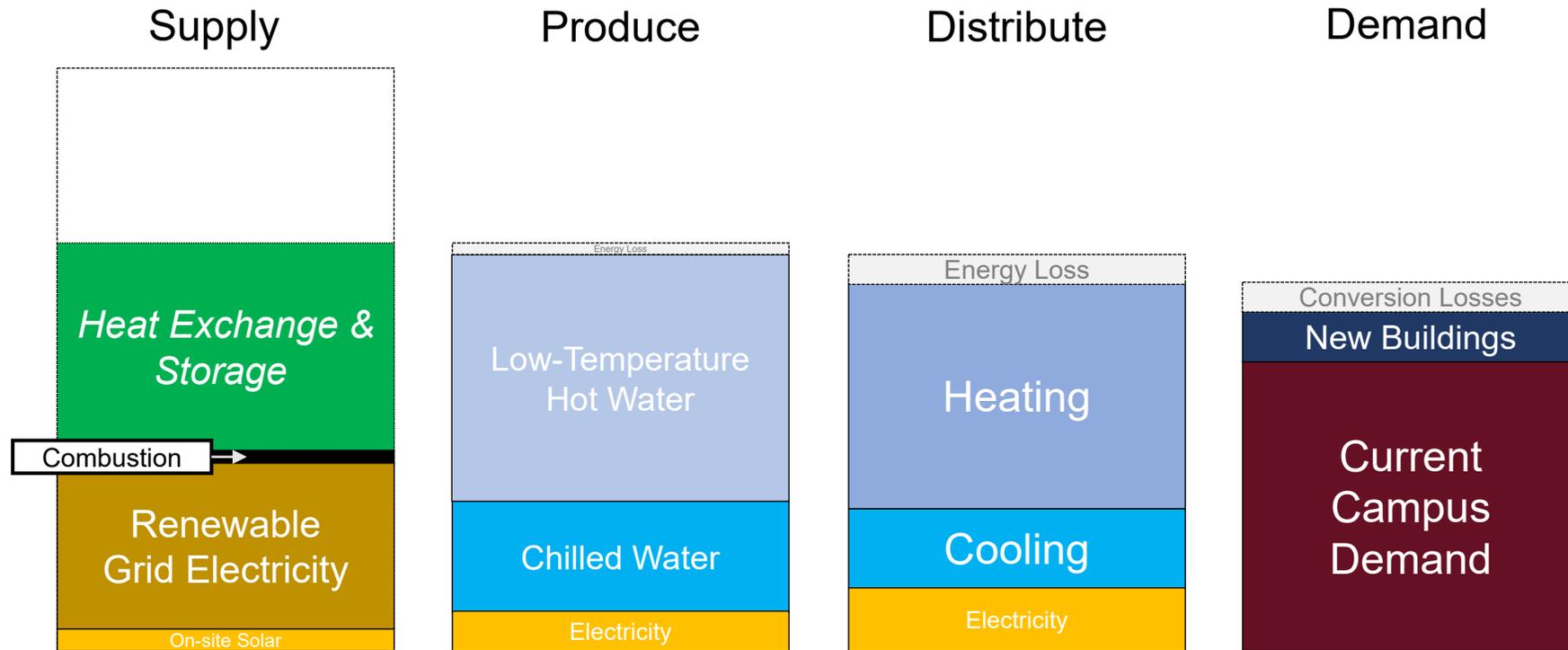
Destination of Choice

100% emissions reduction if matched with renewable energy and meets the charge of the chancellor to “Be Revolutionary.”

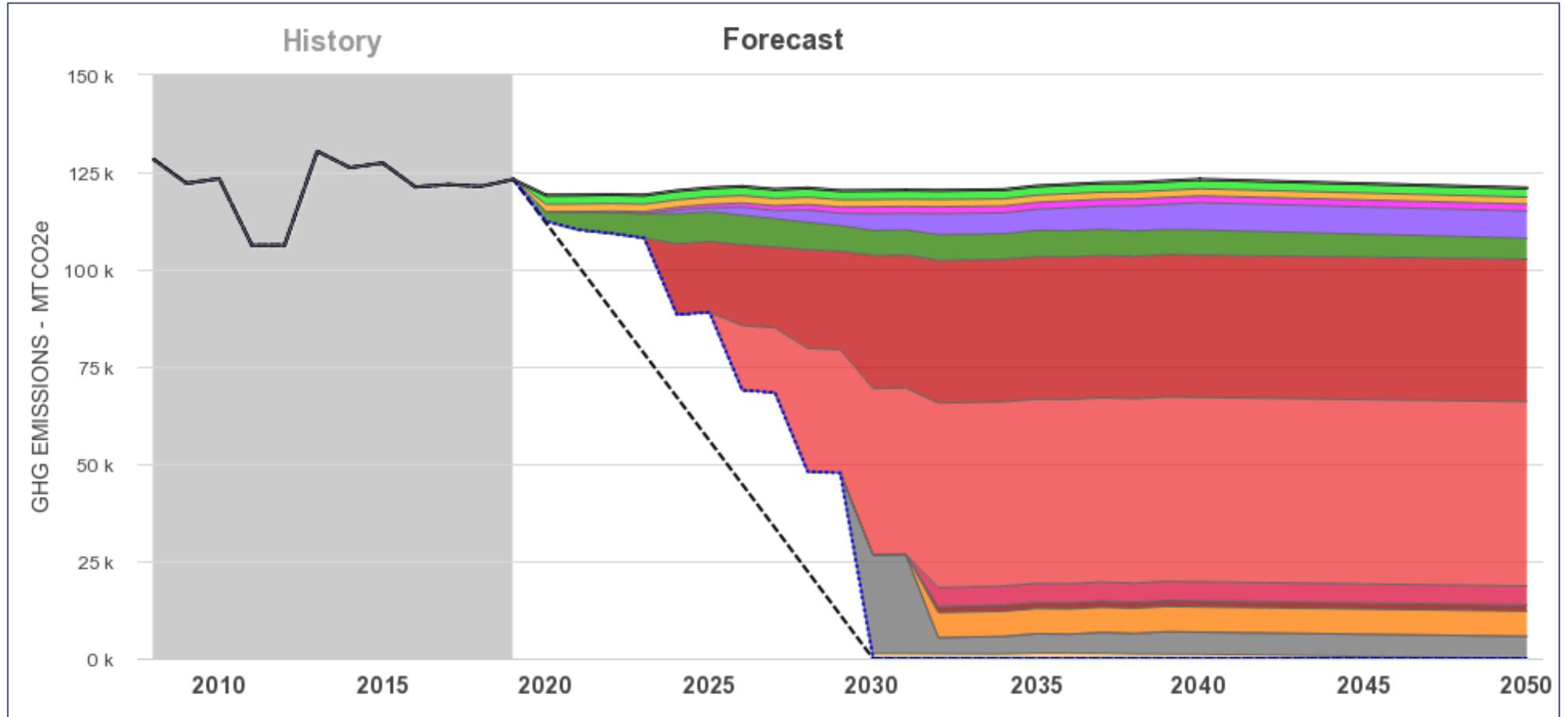
Current District Energy System



Future District Energy System



Energy Transition Recommendation



Key Takeaways

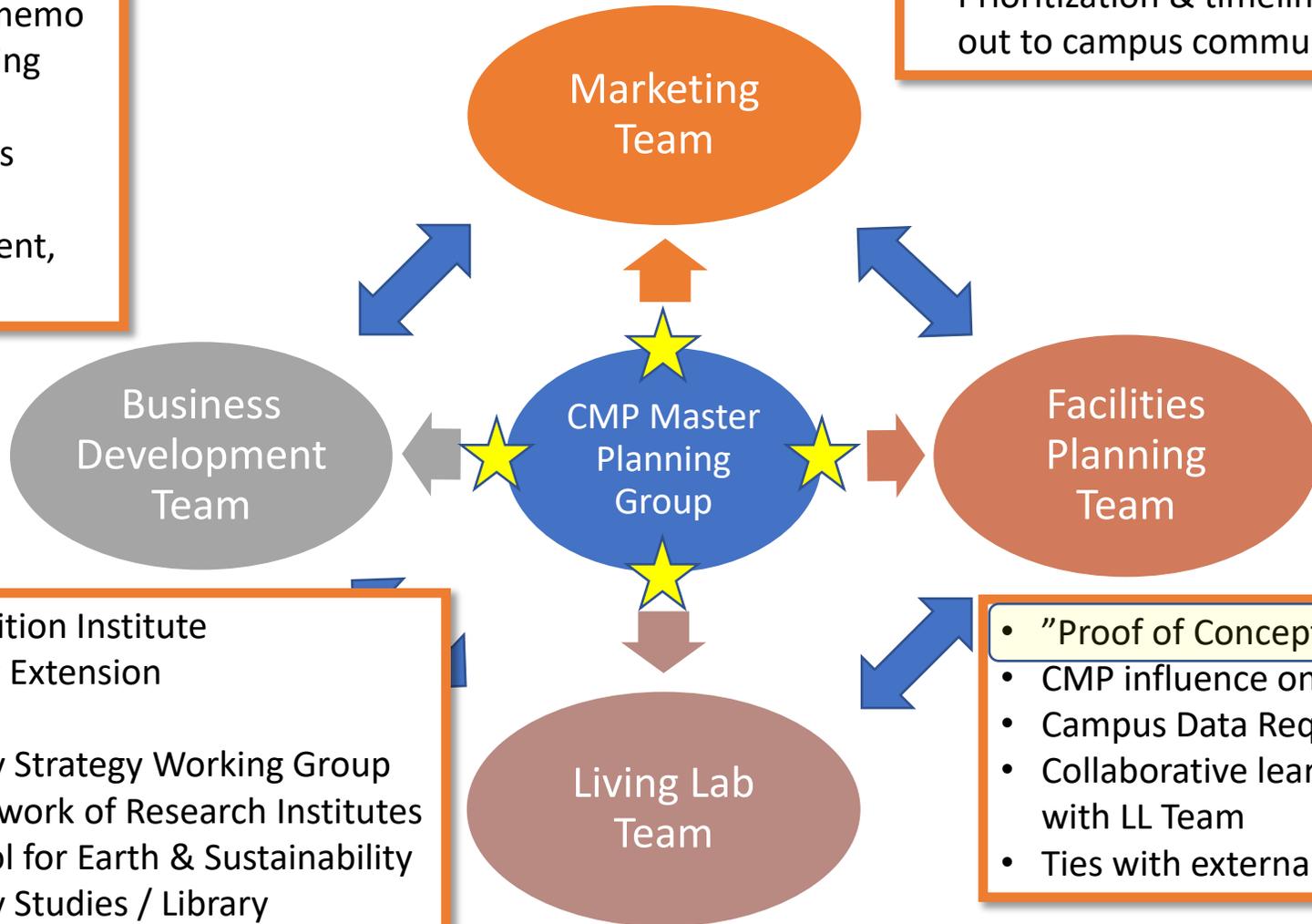
BE REVOLUTIONARY™

1. 100% reliance on renewable energy sources for our campus **is technically possible** with technology available today.
2. A transition is achievable by 2032, **only if aggressive actions starting in 2021.**
3. This would position UMass Amherst as a **leader in the Commonwealth** and provide leadership for higher education.
4. Creation of “revolutionary” educational, research, leadership, and equity opportunities associated with the **cultural shift** in how we operate and relate to the campus.
5. Transition to this new energy platform will enable us to power the campus for **the next 100 years.**



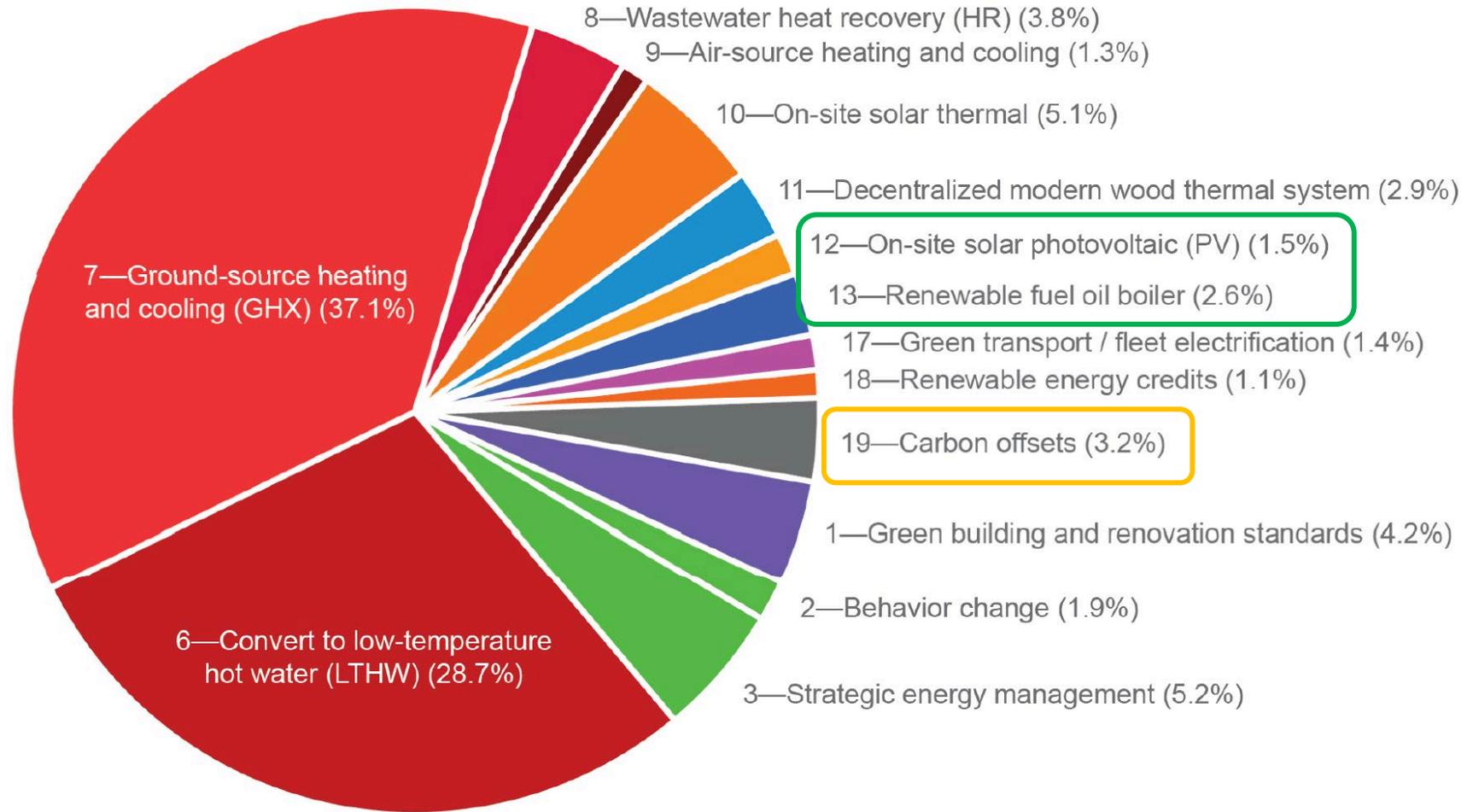
- Financial Strategies memo
- Monitoring & nurturing Local, State, Federal funding opportunities
- Monitoring & nurturing Advancement, donor opportunities

- University-wide campaign development (via Marcomm)
- "Road Show" development
- Prioritization & timeline of roll out to campus community



- Energy Transition Institute
- Clean Energy Extension
- iCons group
- Sustainability Strategy Working Group
- National Network of Research Institutes
- Ties to School for Earth & Sustainability
- Sustainability Studies / Library

- "Proof of Concept" RFP management
- CMP influence on Major Capital Projects
- Campus Data Request management
- Collaborative learning opportunities with LL Team
- Ties with external Utilities



* Not all solutions are included in this portfolio

Figure 9 - 2032 GHG Percent Reduction by Solution

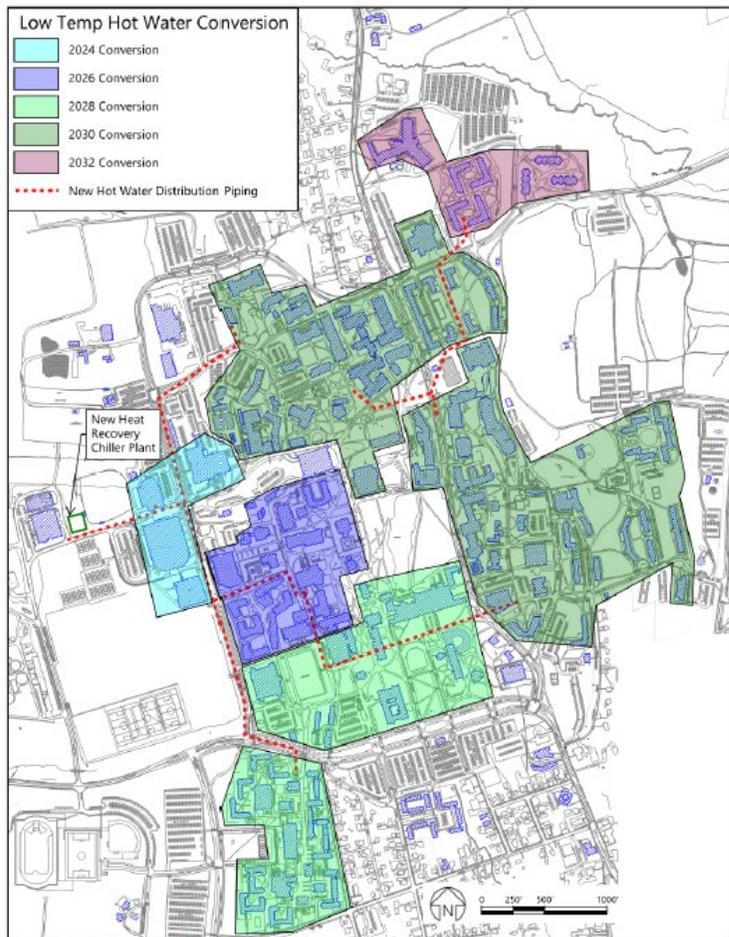
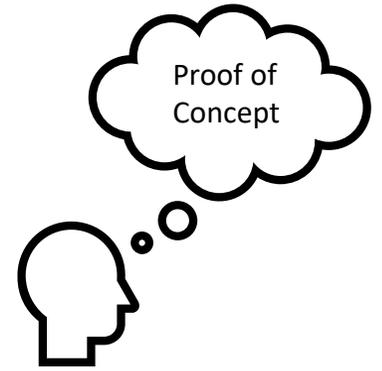
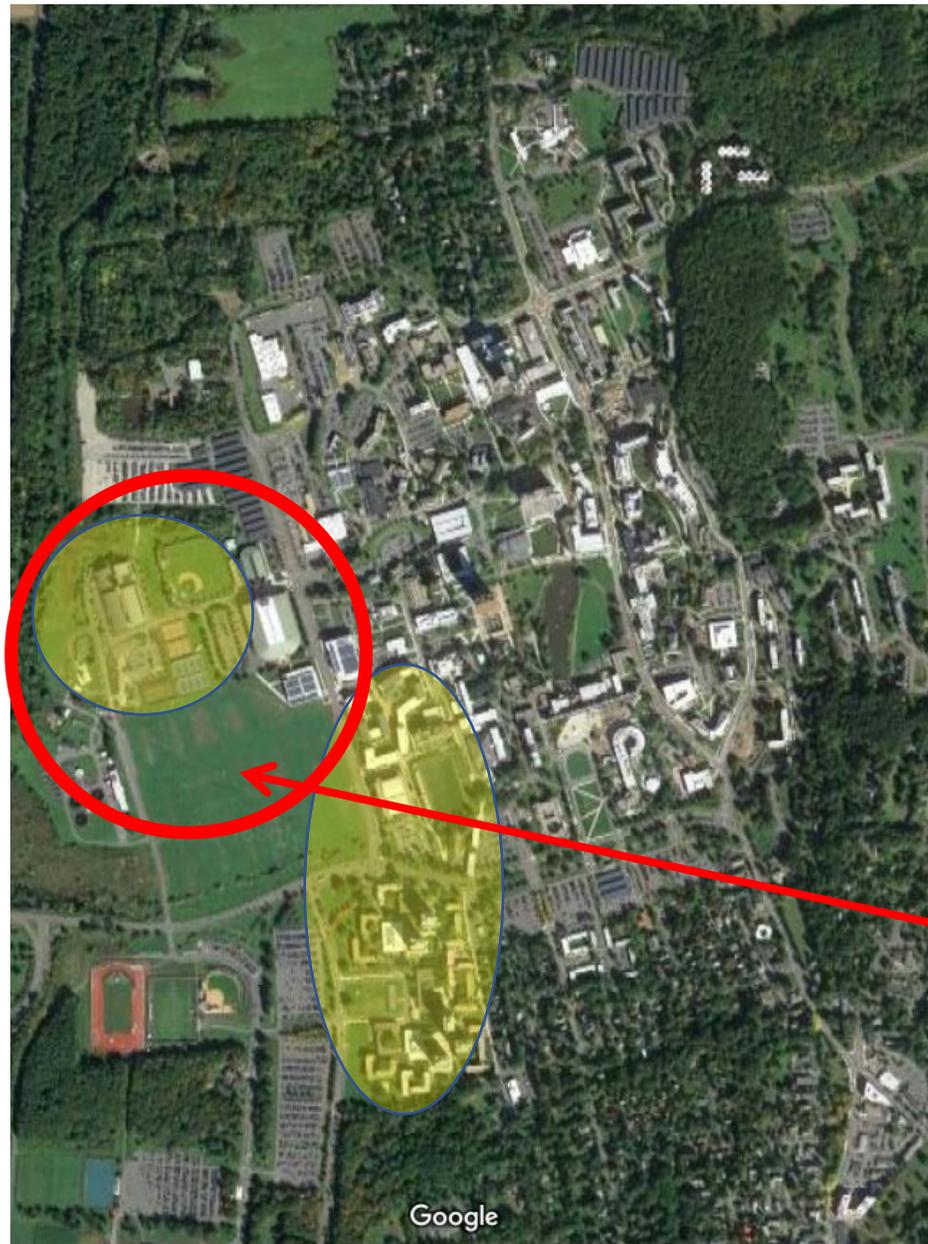


Figure 11: LTHW Conversion Phasing Plan



Full RFP



Phase 1A RFP



PHASE 1A RFP will address:

- Geo testing of possible sites around CHP and Boyden Field
- Comparison of geo well field capacity vs. connected building demand, based on metering only

FULL RFP will address:

- Geo testing of possible sites around CHP and Boyden Field
- SD work scope & cost for ~42 building conversions, incl CHCRC, SW Res Halls + Boyden
- SD work scope & cost for establishment of 1st “phase” of EEC, including memo on regionalization vs. centralized
- Evaluation of TES needs/locations
- Evaluation of building envelope needs
- **Establishment of practical working/design standards for future system mods/implementation (i.e. LTHW design temps, operational fail-safes)**
- Timeline of building “cut-overs” vs. need for temp substations, etc. for Proof of Concept scope. Will inform future phases of work.
- Establishment of “unit costs” for small, medium, large building retrofits for future budgeting
- Memo on routing options towards N, E, S directions of campus, including re-use of (E) U/G pathways

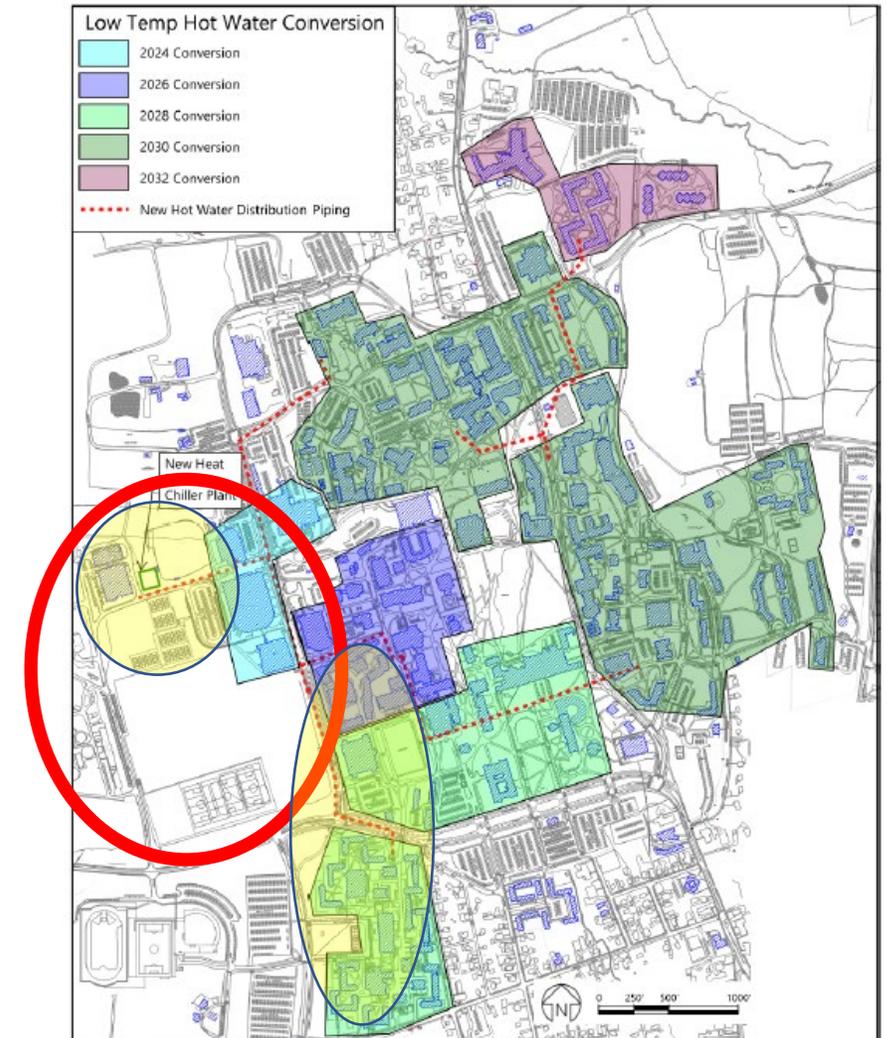


Figure 11: LTHW Conversion Phasing Plan



carbon neutral universities



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Tools

Colleges/Universities / Carbon neutrality



Colgate University
Hamilton



Colorado College
Colorado Sp...



Bowdoin College
Brunswick



Dickinson College
Carlisle



Allegheny College
Meadville



Colby College
Waterville

https://secondnature.org > climate-action-guidance > car... ⋮

Carbon Neutral Colleges and Universities - Second Nature

American University	Bates College	Bowdoin College	Colby College
Colgate University	Colorado College	Dickinson College	Middlebury College

https://secondnature.org > media > colleges-commit-to... ⋮

Colleges commit to carbon neutrality. Getting there is hard

Only seven institutions have announced they've reached **carbon neutrality** over the past decade: American **University** in Washington, D.C.; Colgate **University** in ...

State & Federal Funding?

- Most of fed opportunities will likely be passed through state
- State politics will be key & there are dynamics at play (Gov & Lt. Gov not seeking re-election...)
- Infrastructure Bill: Critical Facility Modernization. This section appropriates \$500 million for DOE to provide funding to states for the purposes of resiliency, energy efficiency, renewable energy, and grid integration improvements at public and non-profit buildings
 - Est \$12M to MA state
- We need a “ready-made” implementable plan. This reqs the Full RFP vision



Any Questions?

Thank You!

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& Renewables*

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UMassAmherst
The Commonwealth's Flagship Campus