



Carleton

Carleton College Utility Master Plan Engagement Strategies

Martha M. Larson, CEM
Manager of Campus Energy & Sustainability

March 7, 2018



Carleton College, Northfield, MN

Campus Statistics:

- Private undergraduate liberal arts college
- Founded in 1866
- Approx. 2000 students
- 2,000,000 SF, 40+ buildings
- 1,000 acres (*800 Arboretum*)



Carleton College, Northfield, MN

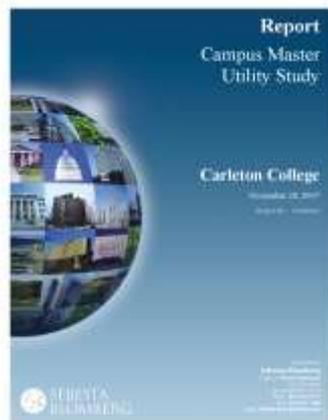
Environmental Statistics:

- Campus EUI 100-120 kBTU/SF/yr
- Greenhouse gas emissions ~ 22,000 MTCDE/yr
- 1.68 MW wind turbine connected to the campus grid
- 1.65 MW wind turbine connected to the public grid
- 9.8 kW rooftop solar PV plus small solar thermal
- Climate Action Plan targets carbon neutrality by 2050



Carleton College Utility Master Plan Project Summary

Carleton's utility plan is part of a 10-year planning progression.



Campus Master
Utility Study
2007



Climate Action Plan
2011



Strategic Plan
2012



Facilities Master Plan
2014



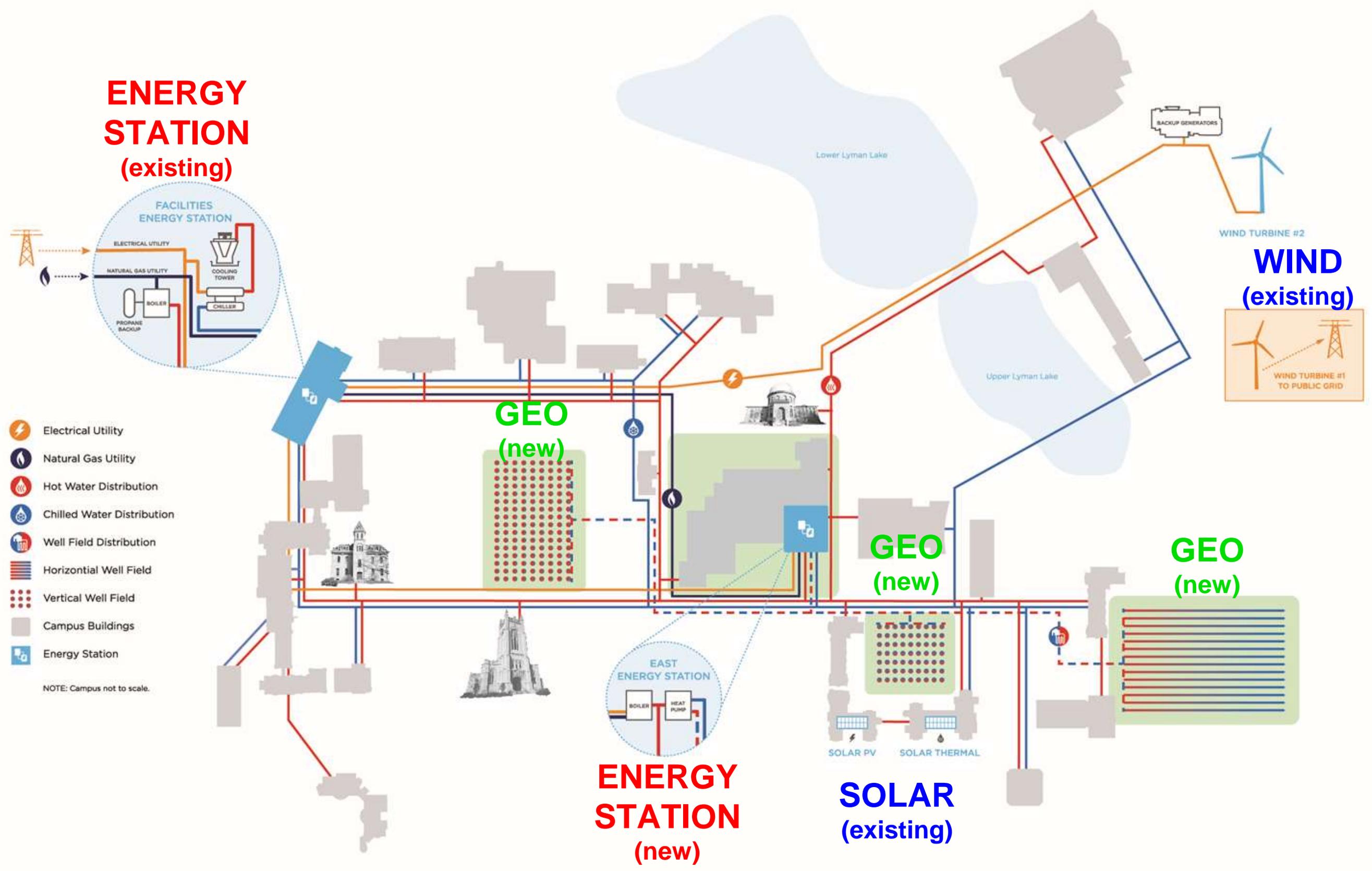
Utility Master Plan
2017

Key objectives:

1. Replace the **aging and outdated** central plant facilities, campus steam distribution network and controls
1. Provide for **future loads** as envisioned in the Facility Master Plan
1. Reduce our **operating costs and carbon emissions** significantly and permanently

Plan summary:

1. Transition from central steam to **hot water distribution**
1. Install a central **geothermal heat pump**
 - captures simultaneous heating and cooling energy
 - uses the earth's mass as a thermal battery
1. Install **high efficiency condensing boilers** to supplement the heat pump during peak heating demand
1. **FUTURE PHASE:** Invest in efficient and/or renewable **electrical generation system(s)**



- Electrical Utility
- Natural Gas Utility
- Hot Water Distribution
- Chilled Water Distribution
- Well Field Distribution
- Horizontal Well Field
- Vertical Well Field
- Campus Buildings
- Energy Station



Wow - that's big change!

How did we get our campus community to buy in?

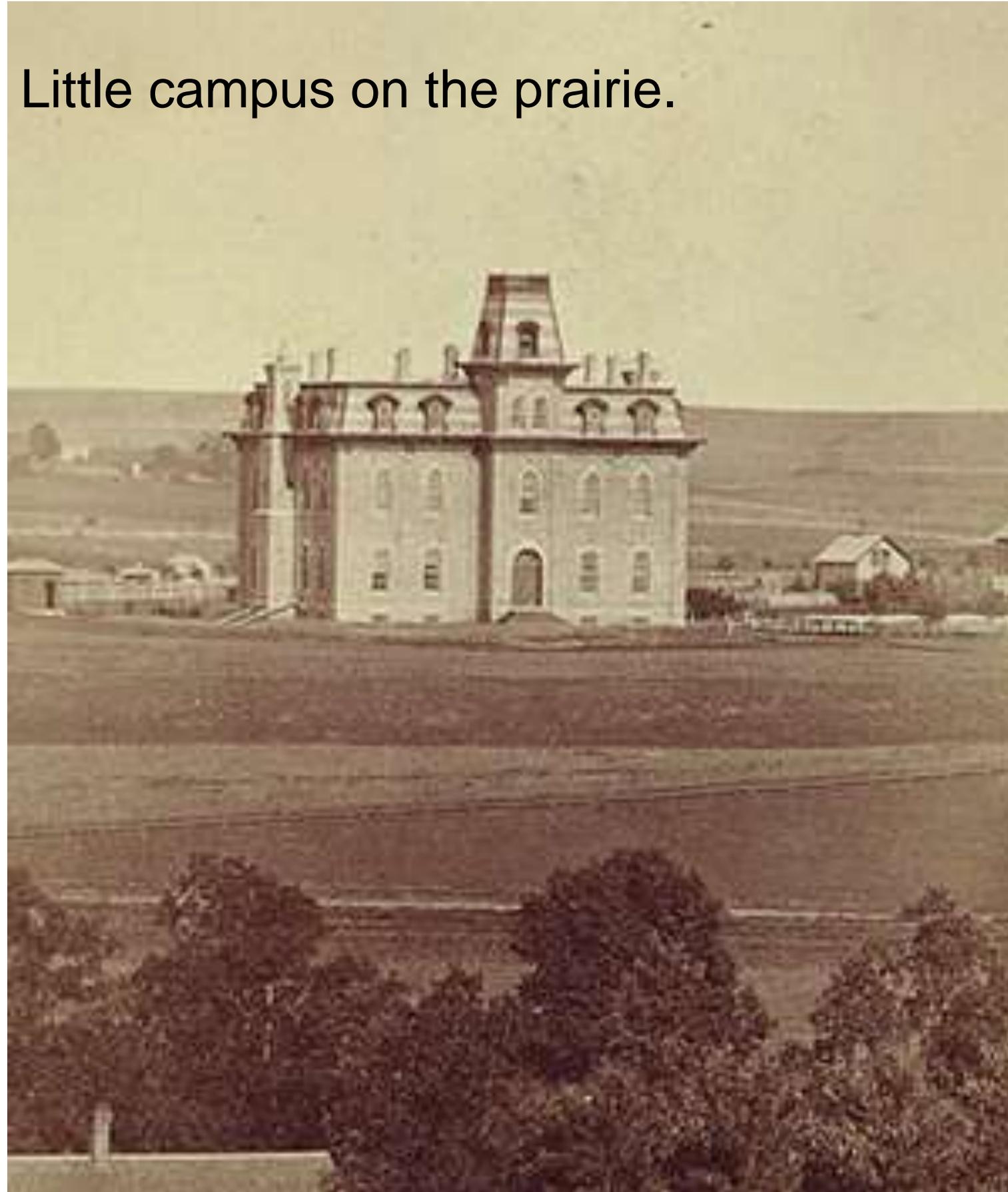
Engagement strategies:

1. Establish a vision.
2. Build off of existing plans.
3. Invest in good communication tools.
4. Reach out to the campus community.

And talk about the project!

Establish a vision.

Little campus on the prairie.





First building constructed in the 1910 campus master plan



We are now planning for the *next* 100 years.



Expanding the steam tunnels



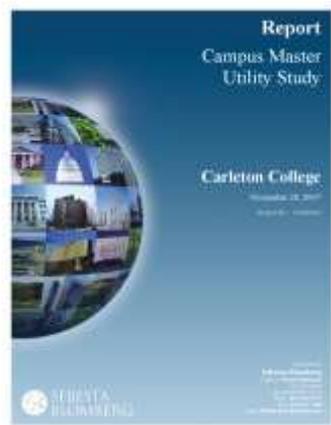
Installing a wind turbine (2011)

We are always asking:

- How much should we invest now to save long term?
- What technology investments will serve us well into the future?

Build off of existing plans.

How can we incorporate the goals of prior strategic plans into the utility planning process?



Campus Master Utility Study
2007



Climate Action Plan
2011



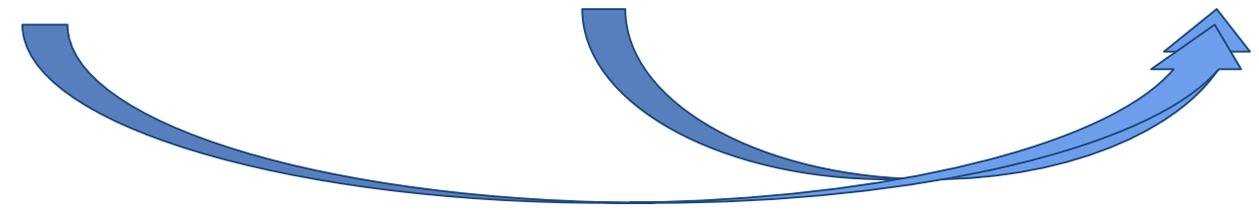
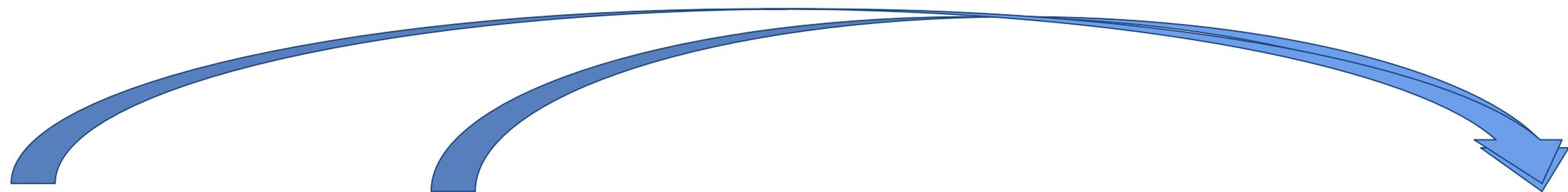
Strategic Plan
2012



Facilities Master Plan
2014



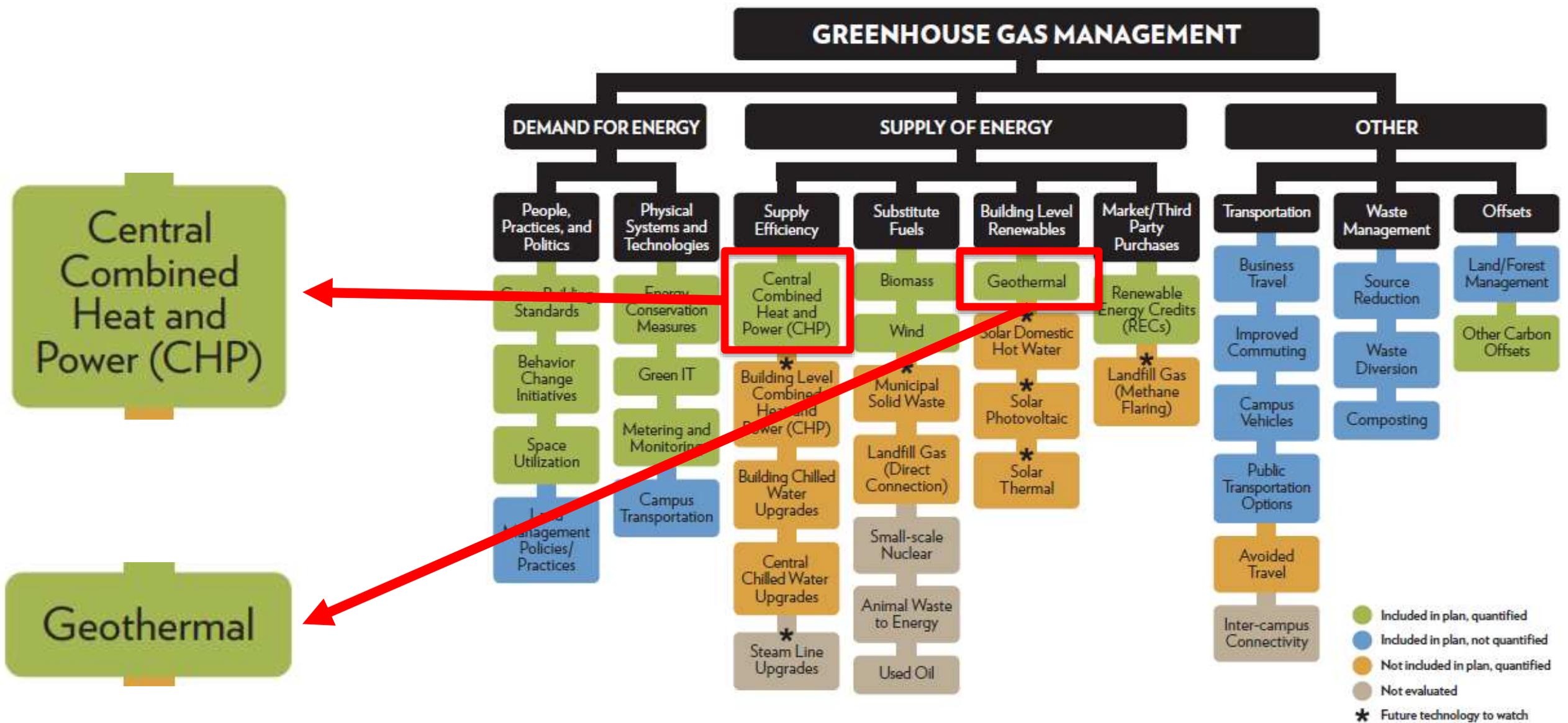
Utility Master Plan
2017





2011 CAP: carbon reduction strategies

What are the utility planning opportunities?





2012 Strategic Plan: six “critical next steps”

What are the utility planning opportunities?

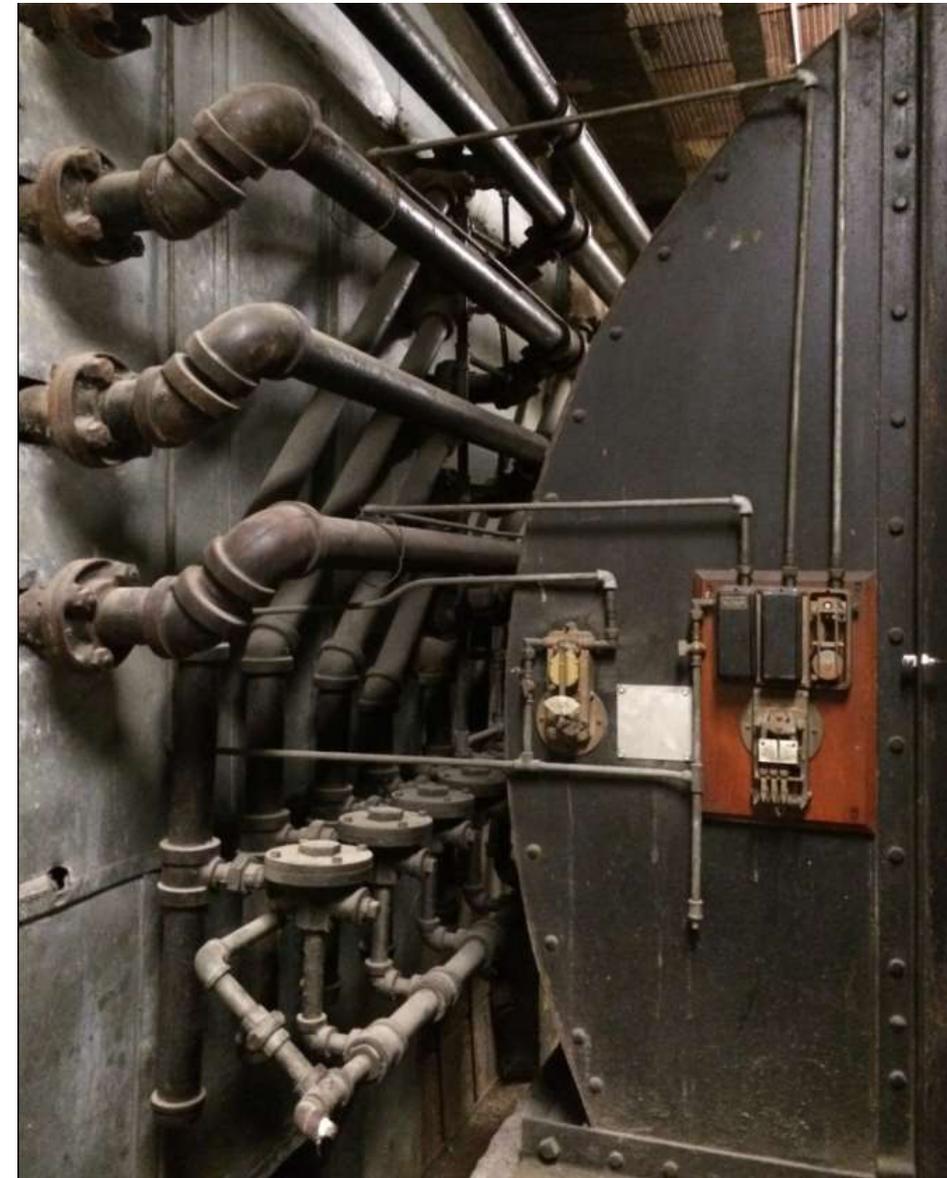
1. Prepare students more robustly for fulfilling post-graduation lives and careers
2. Enhance our curriculum to improve liberal arts teaching and learning
3. Strengthen the socio-economic diversity of our student body
4. Maintain a self-sustaining economy with a growing endowment per student
- 5. Make focused investments in facilities that directly advance our mission**
6. Embrace collaborative opportunities with other institutions to enhance our academic programs and save costs



2014 Facilities Master Plan Priorities

What are the utility planning opportunities?

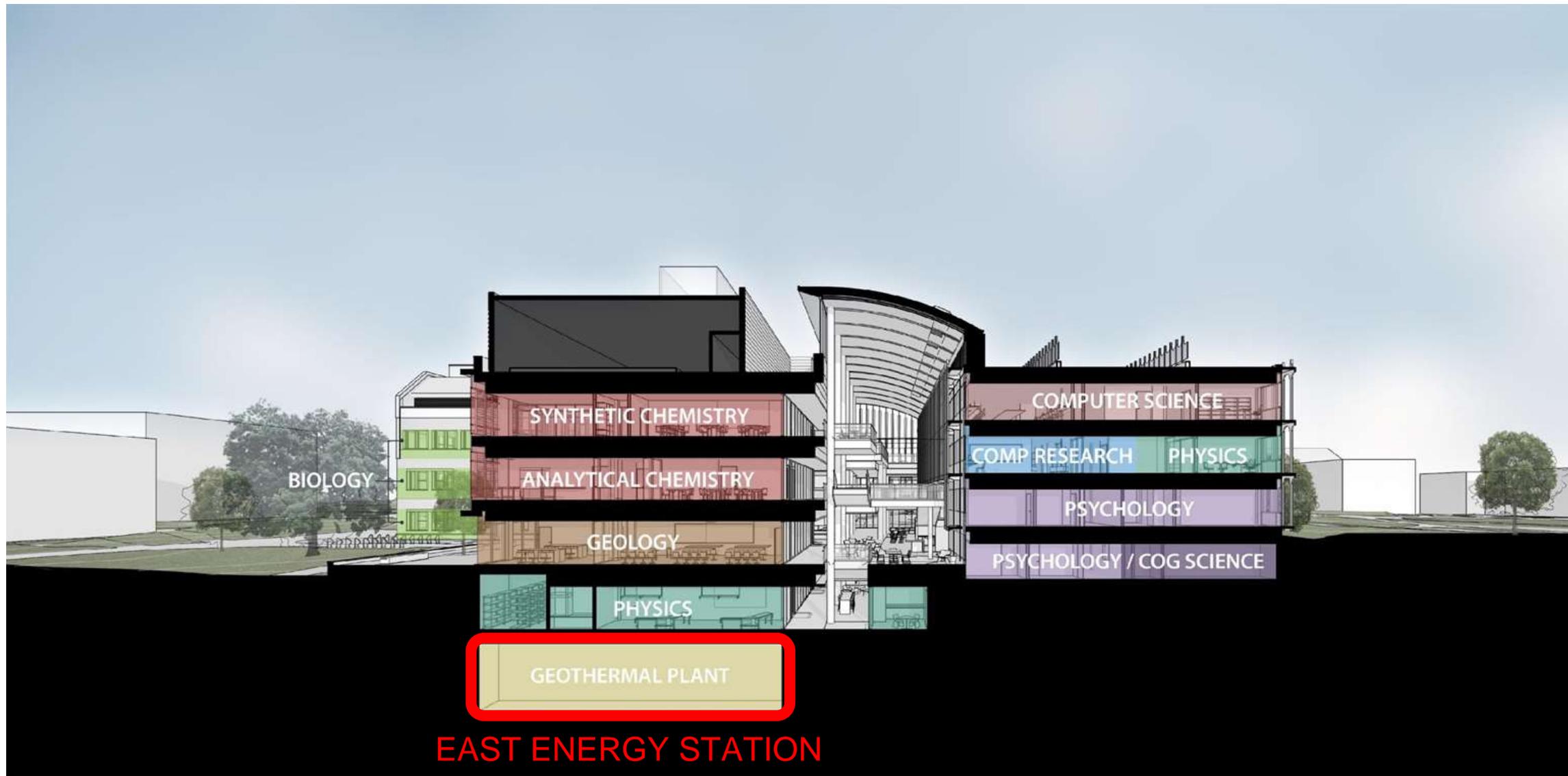
- Long-term precinct plan for the campus
- Investment in science facilities
- Investment in music & public event facilities
- Assess number, location, and size of needed classrooms
- Other needs incl. admissions and Academic Support Center



PRIORITY: Investment in music and event facilities

OPPORTUNITY: Skinner Chapel Upgrade

First low temperature (120 deg) hot water building.



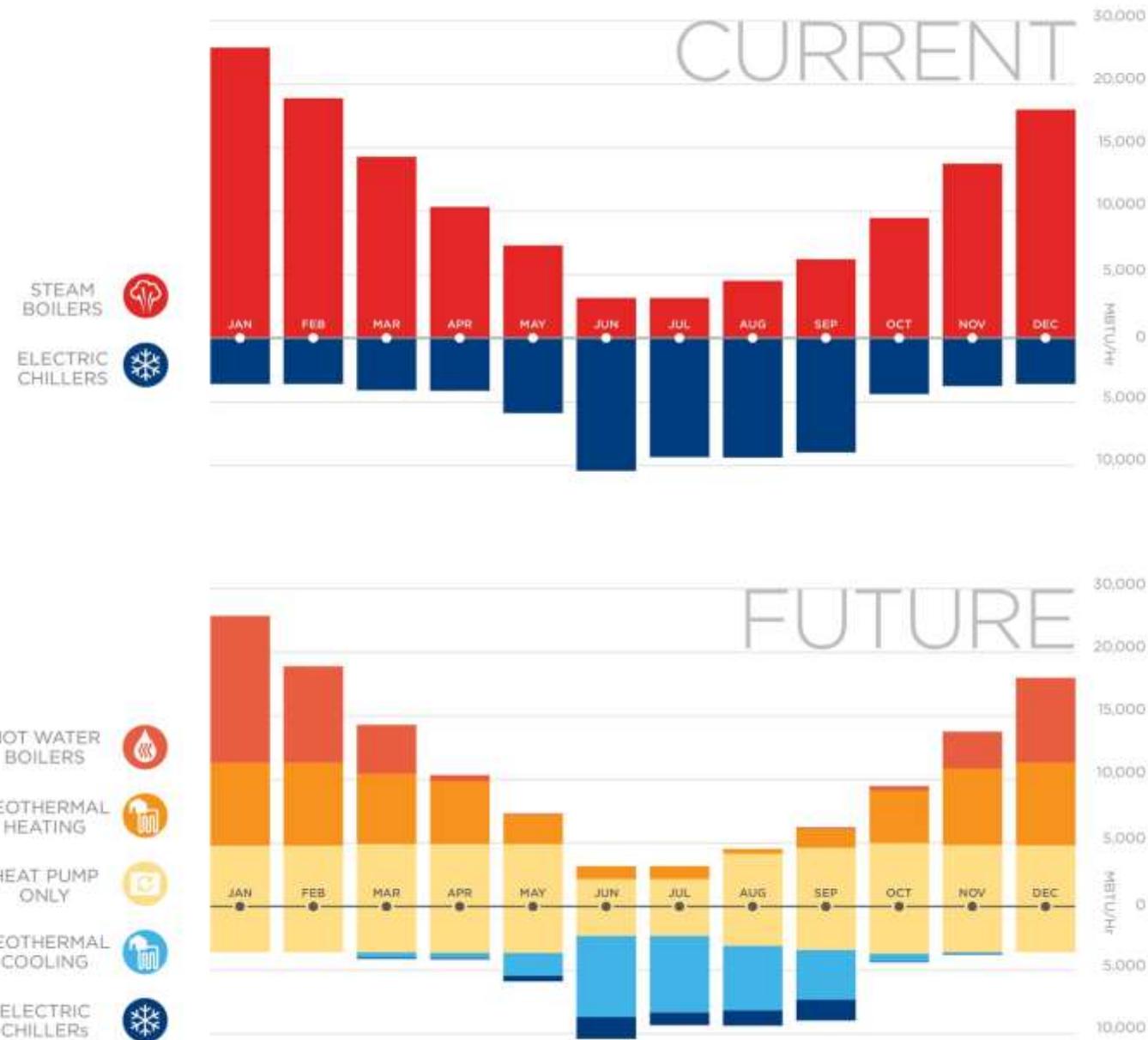
PRIORITY: Investment in science facilities

OPPORTUNITY: New Science Complex

New geothermal satellite plant (East Energy Station)

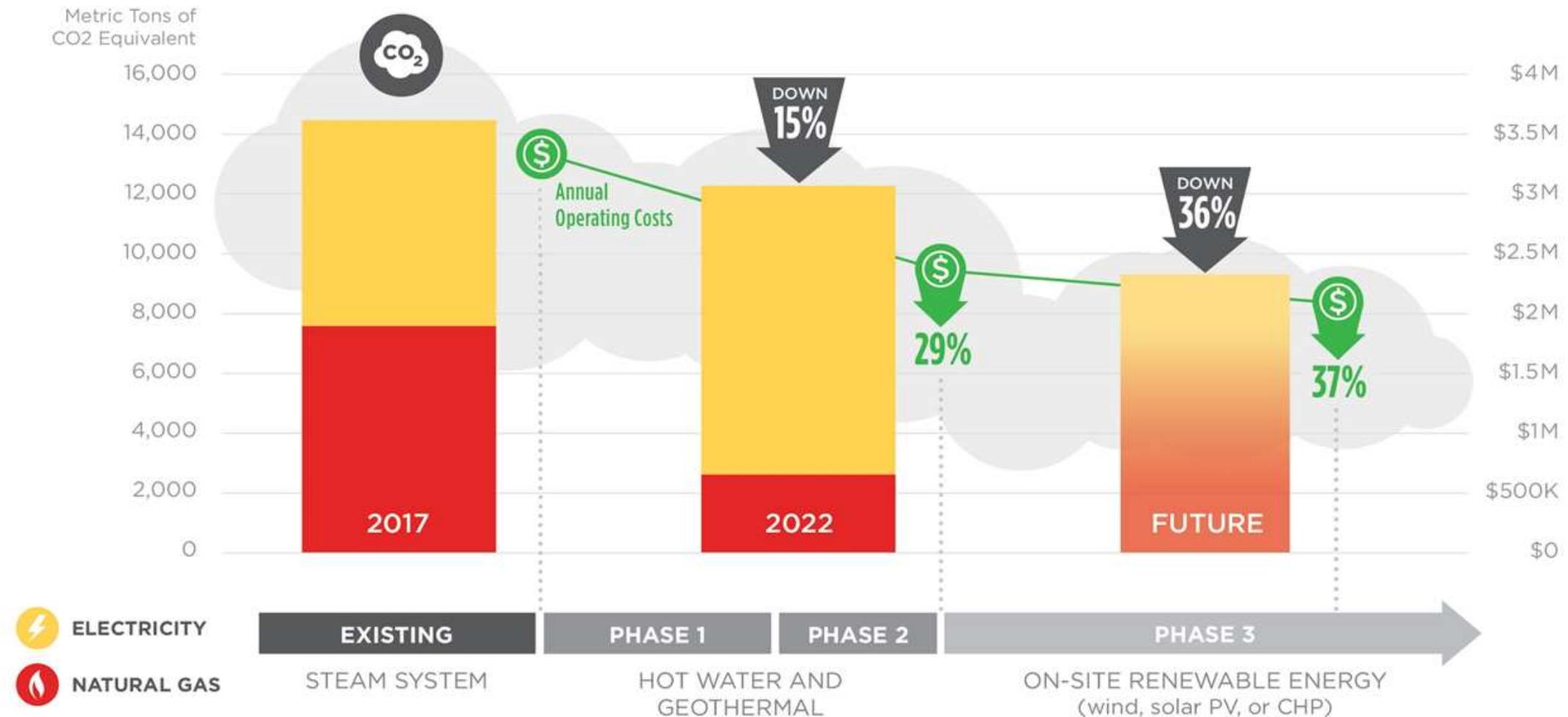
Invest in good
communication tools.

CARLETON HEATING & COOLING LOAD PROFILES



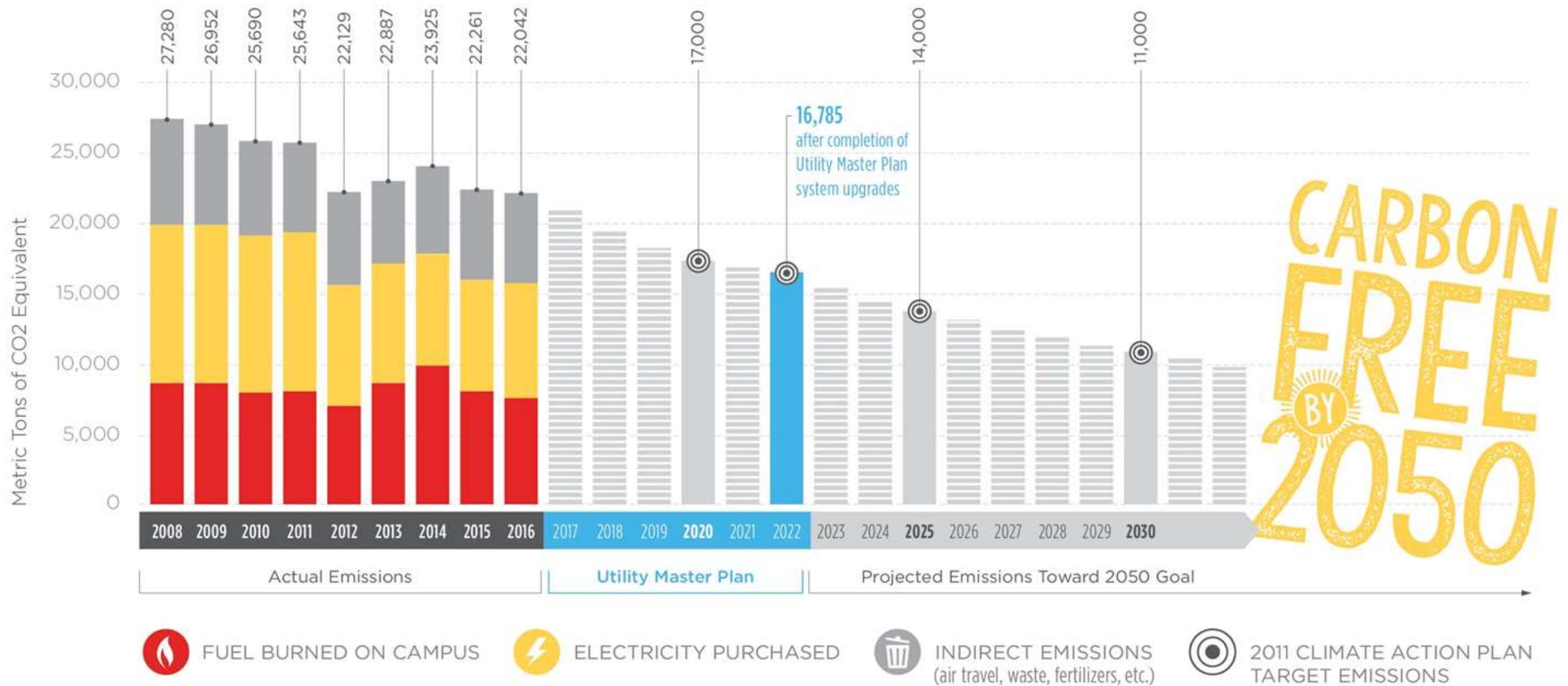
KEY MESSAGE #1: The proposed utility plan diversifies our fuel mix and introduces much more flexibility to incorporate current and future technologies.

CENTRAL PLANT ANNUAL EMISSIONS & OPERATING COST REDUCTIONS



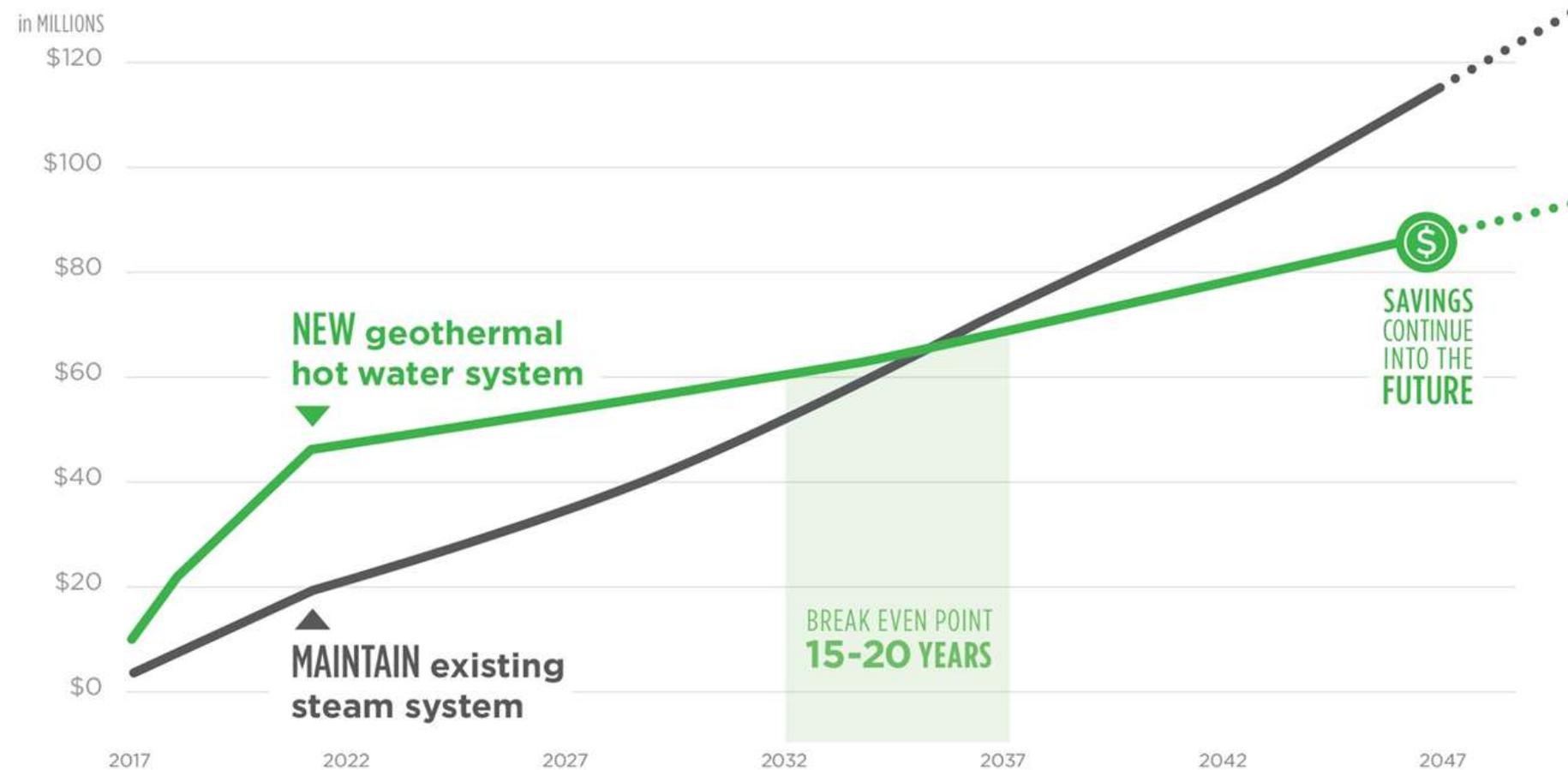
KEY MESSAGE #2: The proposed utility plan reduces both annual operating costs and carbon emissions.

GROSS EMISSIONS PROJECTIONS



KEY MESSAGE #3: The proposed utility plan keeps us on track with carbon reduction goals outlined in our 2011 Climate Action Plan.

CAPITAL + OPERATING COST COMPARISON



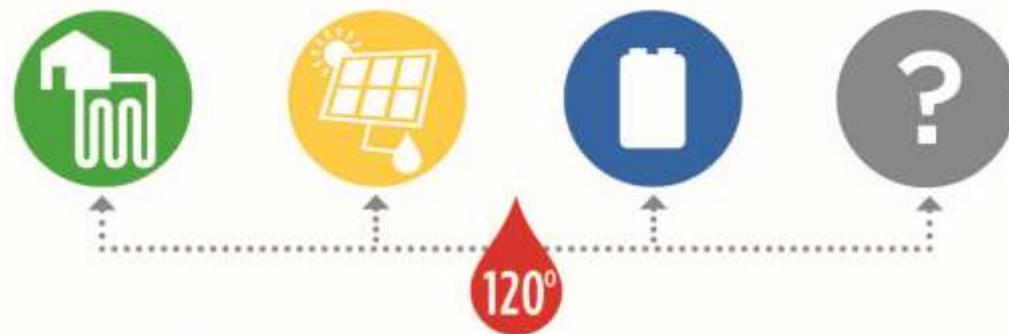
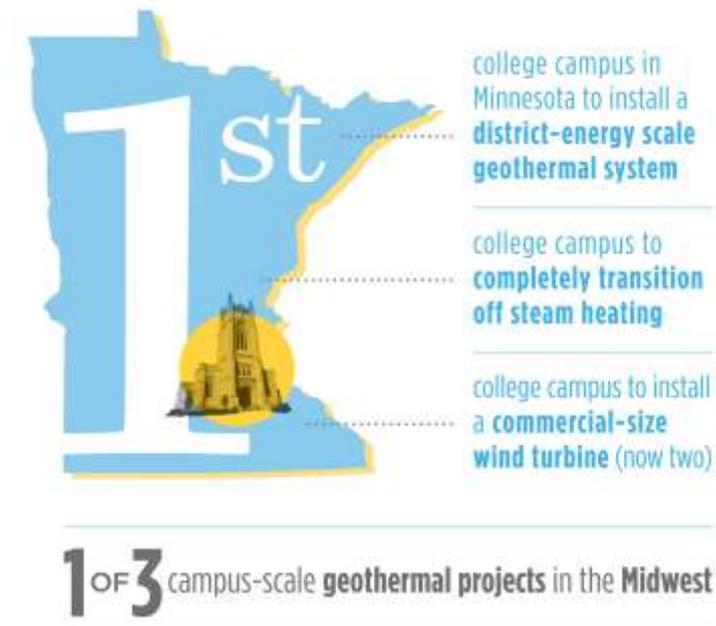
KEY MESSAGE #4: The proposed utility plan breaks even in 15-20 years compared to the cost of maintaining the existing steam plant.

Reach out to the
campus community.

Fun facts are not only “fun”, they also generate campus pride and support for the project.

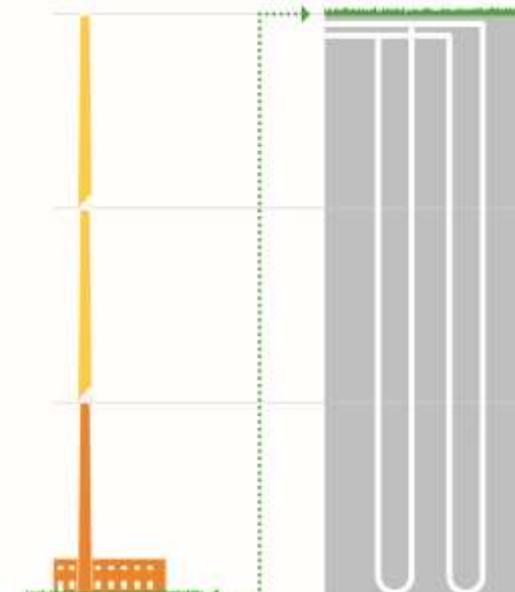


60 miles
OF GEOTHERMAL PIPING
TO BE INSTALLED UNDER
THE CARLETON CAMPUS



The new 120 degree hot water heating system will be capable of connecting to many different technologies including geothermal, solar thermal, fuel cells and other emerging technologies, resulting in a more diverse and resilient energy system with reduced carbon emissions.

Each vertical bore is
520 FEET DEEP
= to the height of **3 CARLETON SMOKE STACKS**



The project website is a one-stop-shop for project information....

Carleton College Utility Master Plan

- Home
- The Plan
- Planning Process
- Charts & Graphs
- Frequently Asked Questions
- Fun Facts
- Project Updates
- Bore Field Maps
- Press & Presentations
- Project Team
- Carleton Utilities History



The last time Carleton College made a major shift in its campus utilities was over 100 years ago with construction of the central plant in 1910. Before that, each individual building was heated by a coal furnace or fireplaces. Now the college is embarking on its utility plan for the *next* 100 years.

Our two wind turbines (installed in 2004 and 2011) have been a big help to our sustainability efforts, but we need to do more to reduce carbon emissions. Our Utility Master Plan furthers the concepts outlined in our [2011 Climate Action Plan](#) which is the guiding document supporting our goal of making Carleton's campus carbon free by the year 2050. Our new utility system will utilize four forms of renewable energy - wind, solar photovoltaic, solar thermal, and geothermal - and is flexible enough to take advantage of future advancements in renewable energy technologies.

When all phases of the Utility Master Plan are complete, Carleton's plant emissions will be reduced by over 35 percent.

Progress

Bell Field: 95 of 95 horizontal bores complete

Mini Bald Spot: 77 of 77 vertical bores complete

Related posts

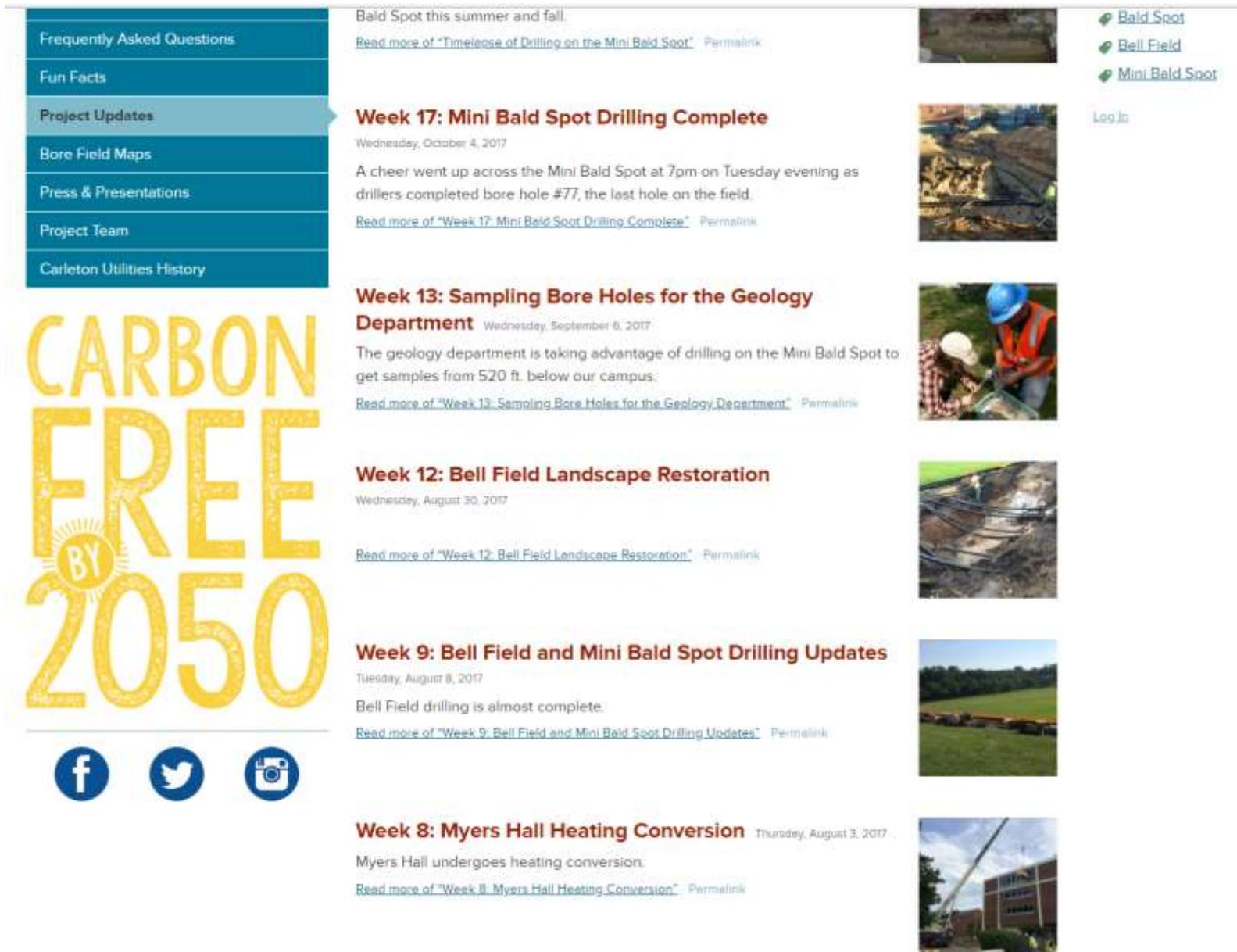
- February 12, 2018 at 5:22 pm
Carleton's New Energy Plan Featured in Rotary Newsletter
- October 5, 2017 at 9:57 am
Timelapse of Drilling on the Mini Bald Spot
- October 4, 2017 at 1:10 pm
Week 17: Mini Bald Spot Drilling Complete
- September 6, 2017 at 2:26 pm
Week 13: Sampling Bore Holes for the Geology Department

[More Project Updates](#)

[More Press & Presentations](#)

CARBON
FREE
BY
2050

...and progress updates.



Project Updates

CARBON FREE BY 2050

Week 17: Mini Bald Spot Drilling Complete
Wednesday, October 4, 2017
A cheer went up across the Mini Bald Spot at 7pm on Tuesday evening as drillers completed bore hole #77, the last hole on the field.
[Read more of "Week 17: Mini Bald Spot Drilling Complete"](#)

Week 13: Sampling Bore Holes for the Geology Department
Wednesday, September 6, 2017
The geology department is taking advantage of drilling on the Mini Bald Spot to get samples from 520 ft. below our campus.
[Read more of "Week 13: Sampling Bore Holes for the Geology Department"](#)

Week 12: Bell Field Landscape Restoration
Wednesday, August 30, 2017
[Read more of "Week 12: Bell Field Landscape Restoration"](#)

Week 9: Bell Field and Mini Bald Spot Drilling Updates
Tuesday, August 8, 2017
Bell Field drilling is almost complete.
[Read more of "Week 9: Bell Field and Mini Bald Spot Drilling Updates"](#)

Week 8: Myers Hall Heating Conversion
Thursday, August 3, 2017
Myers Hall undergoes heating conversion.
[Read more of "Week 8: Myers Hall Heating Conversion"](#)



Student engagement and research opportunities tie the project to our core mission.



Carleton geology major and driller examining soil samples taken from a boring down to 520 ft. underground.



Minnesota Geological Survey staff taking geophysical measurements with their mobile unit.

Questions?



Appendix

Colleges and universities are leading the way on the next generation of energy solutions. Efficiency, decarbonization, and cost management are important elements of these programs, however, how we involve the people in technical and financial solutions is crucial to success. Carleton College and Oberlin College are two stellar examples of institutions that are using their campus energy master plans as an opportunity to provide a richer academic experience, as well as engaging the broader community.