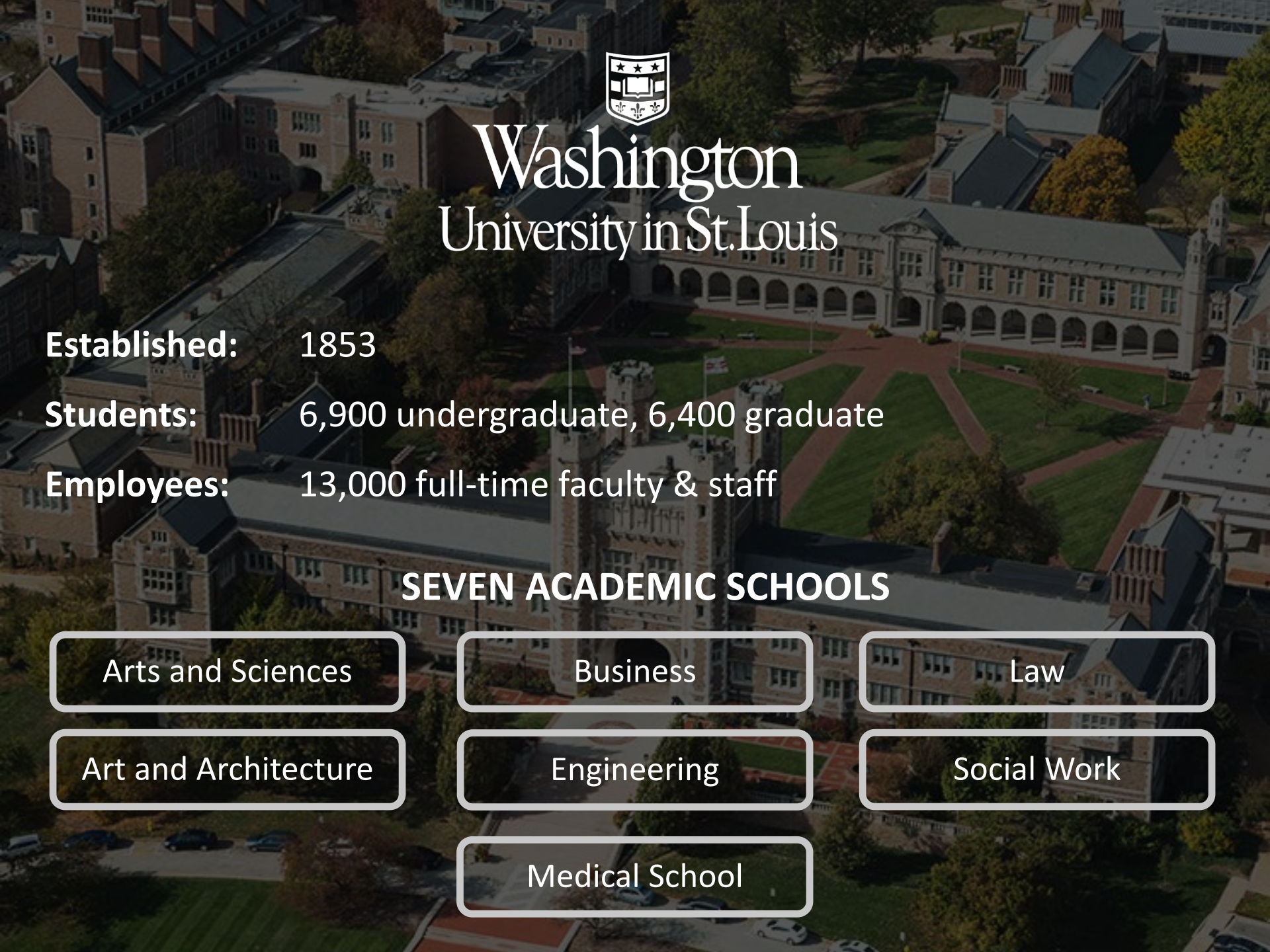
Energy & Emissions Reduction at Washington University in St. Louis



Established: 1853

Students: 6,900 undergraduate, 6,400 graduate

Employees: 13,000 full-time faculty & staff

SEVEN ACADEMIC SCHOOLS

- Arts and Sciences
- Business
- Law
- Art and Architecture
- Engineering
- Social Work
- Medical School

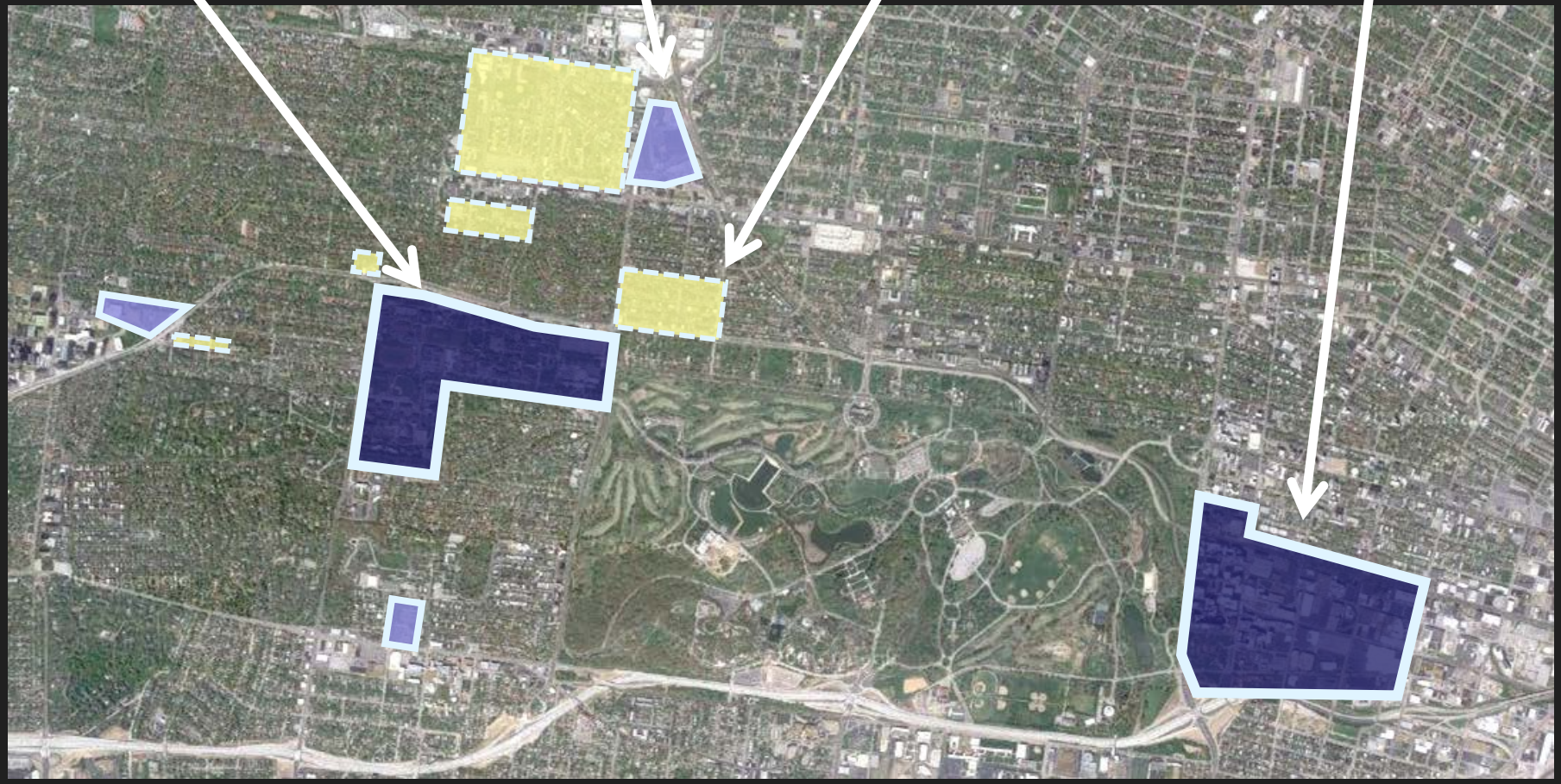
Our Campuses

DANFORTH CAMPUS
169 acres

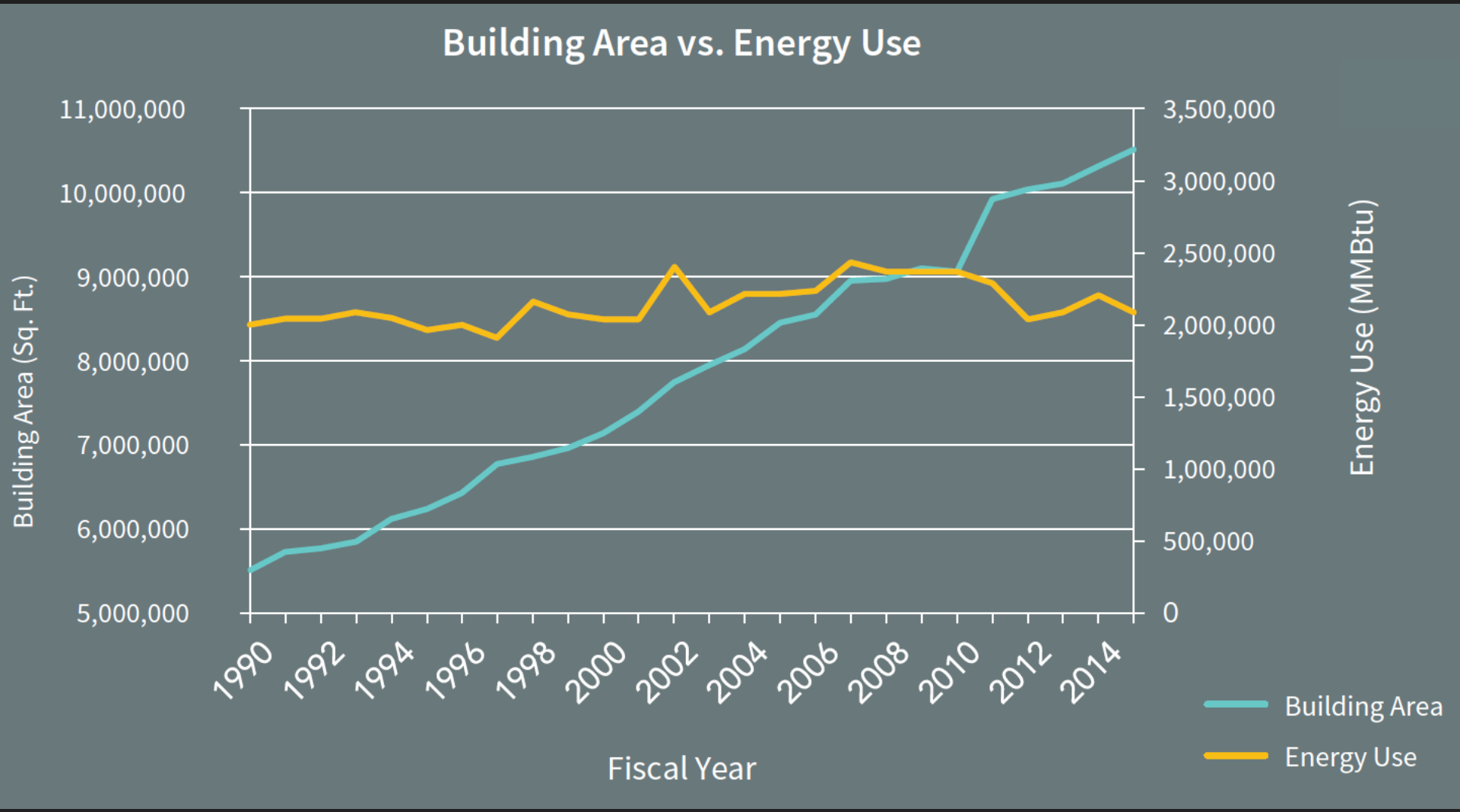
NORTH | WEST | SOUTH
Administrative Campuses

OFF-CAMPUS PROPERTIES
Residential & Commercial Units

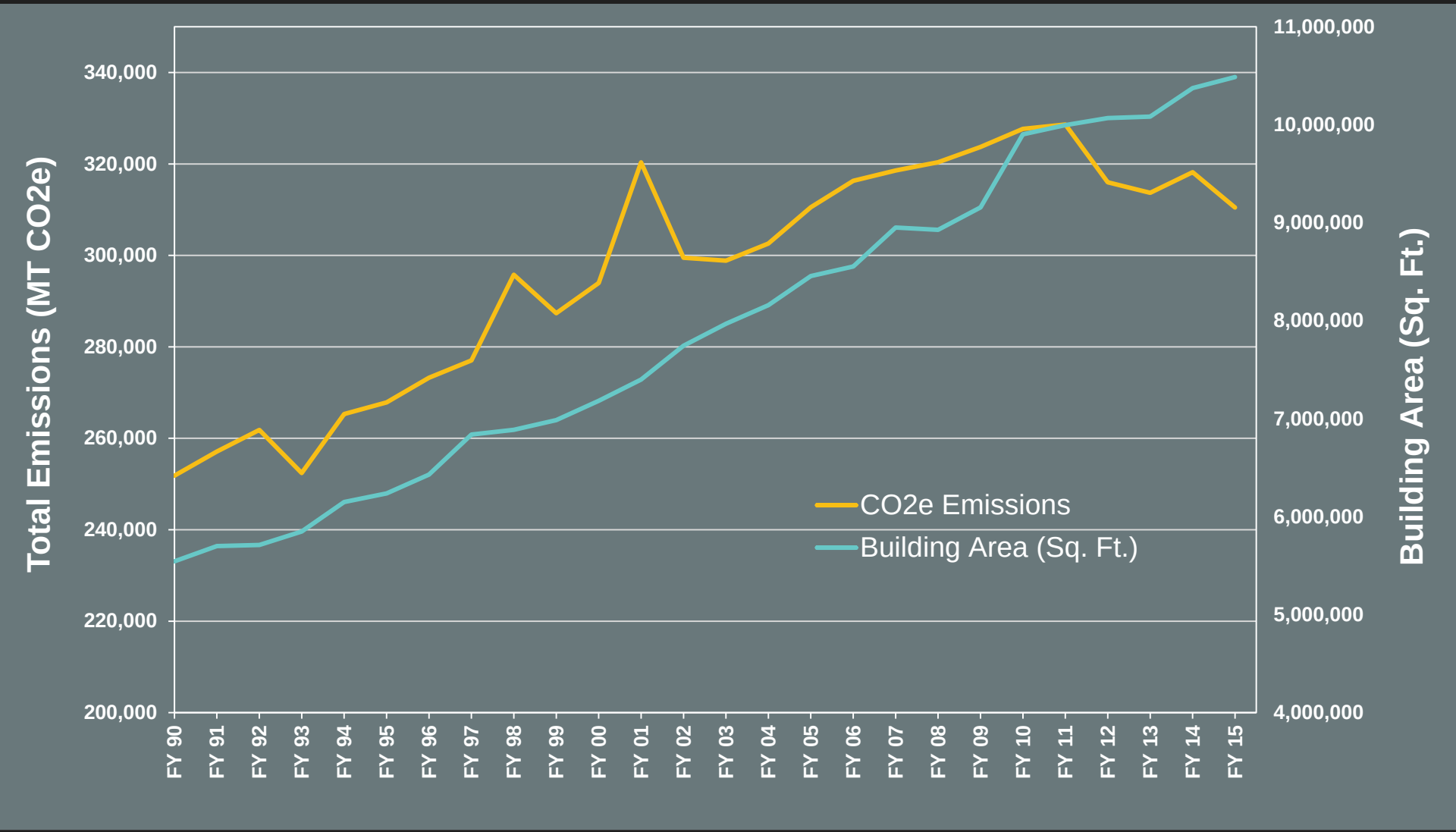
SCHOOL of MEDICINE
164 acres



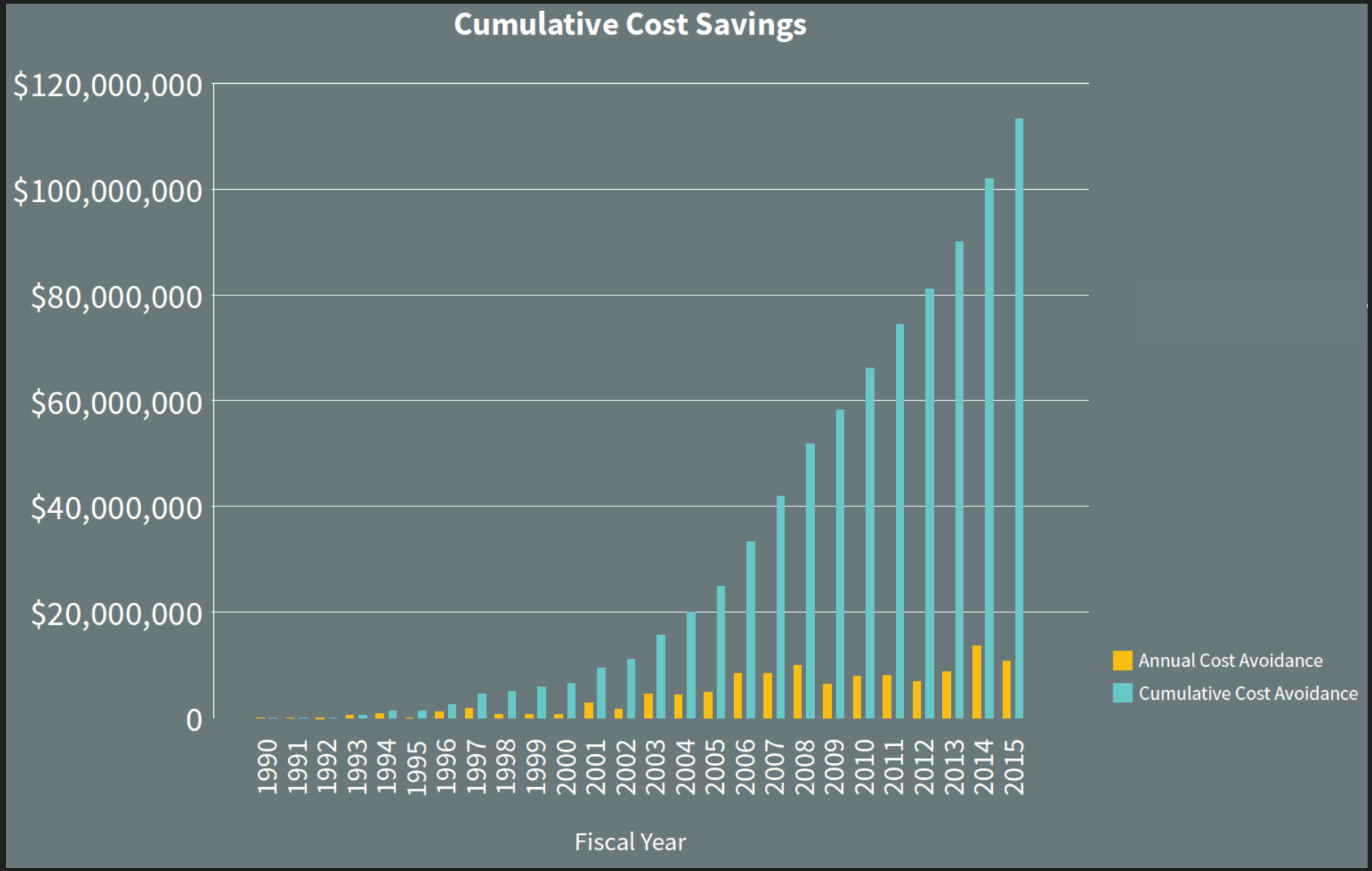
Progress: Energy Conservation



Progress: Carbon Emissions Reduction



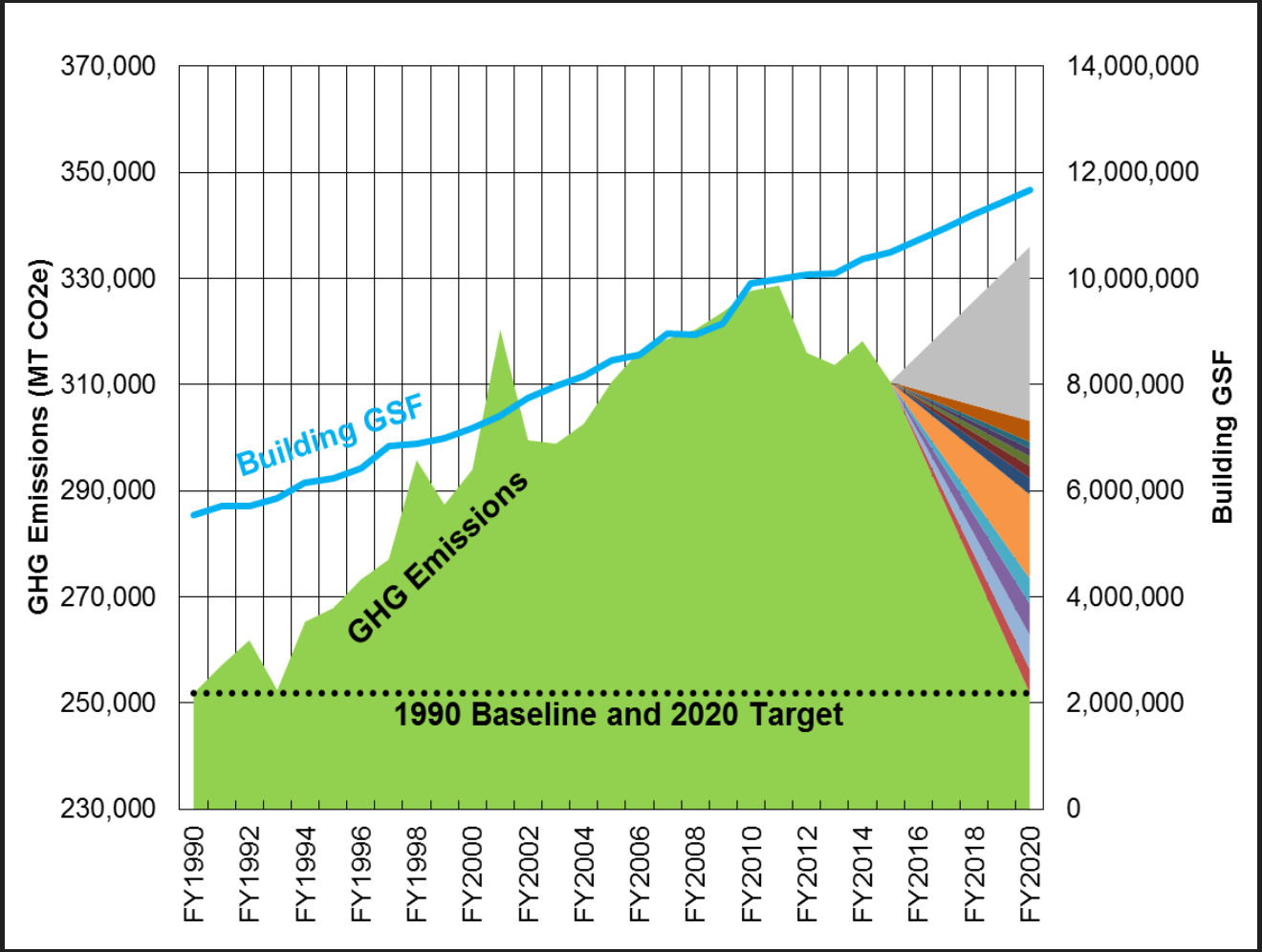
Progress: Energy Cost Avoidance




2015-2020
Strategic Plan for
SUSTAINABLE
OPERATIONS
Washington University in St. Louis

2015 Greenhouse Gas Reduction Goal

Reduce emissions to 1990 levels by 2020, including campus growth
1990 – 2020, without purchasing carbon offsets or RECs.

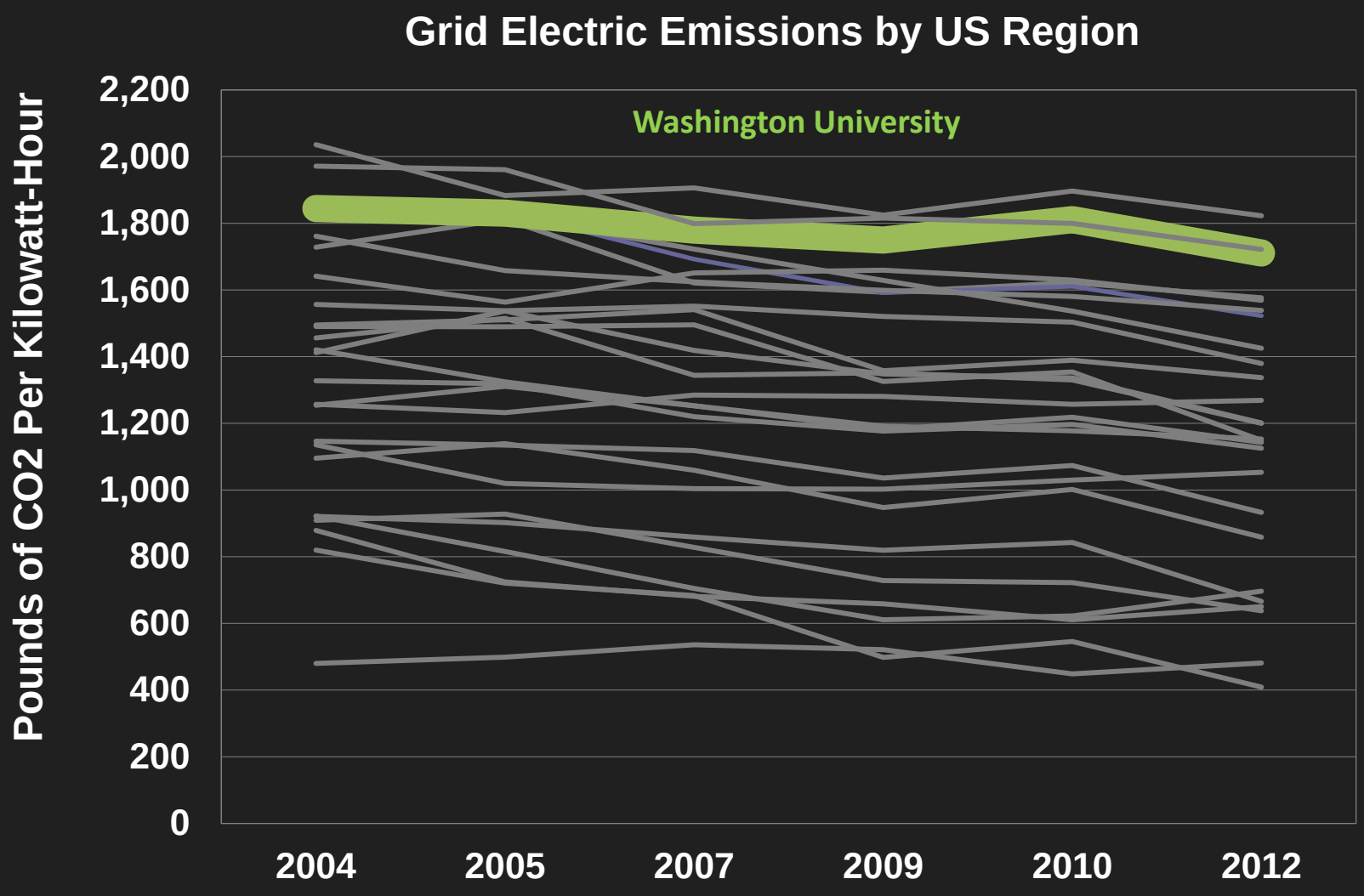


Reduction needed 2015 – 2020:

32,800 from grid
51,300 from WU
84,100 metric tons

Financials
$28M investment
7.4-year payback

Carbon Intensity of Grid Electricity in Missouri



Source: EPA eGRID

Strategies to Achieve Energy and Emissions Goal

Improve efficiency of existing infrastructure

- Utility systems
- Existing buildings

Build highly efficient new buildings

Invest in renewable energy where financially responsible

Explore next generation low-carbon energy systems

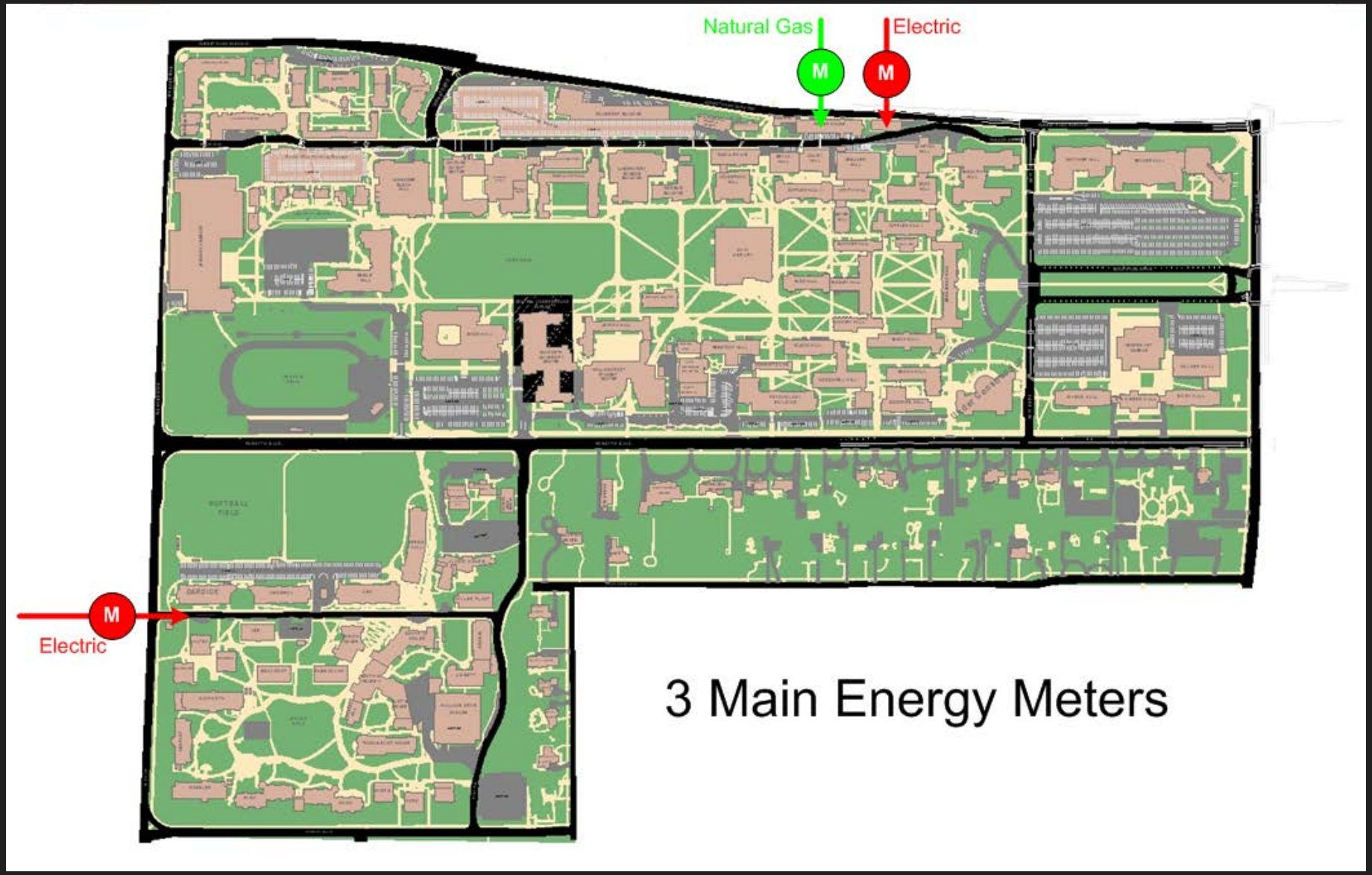
Building Metering

Danforth and Medical campuses recently completed the installation of energy meters in all buildings – over 700 meters

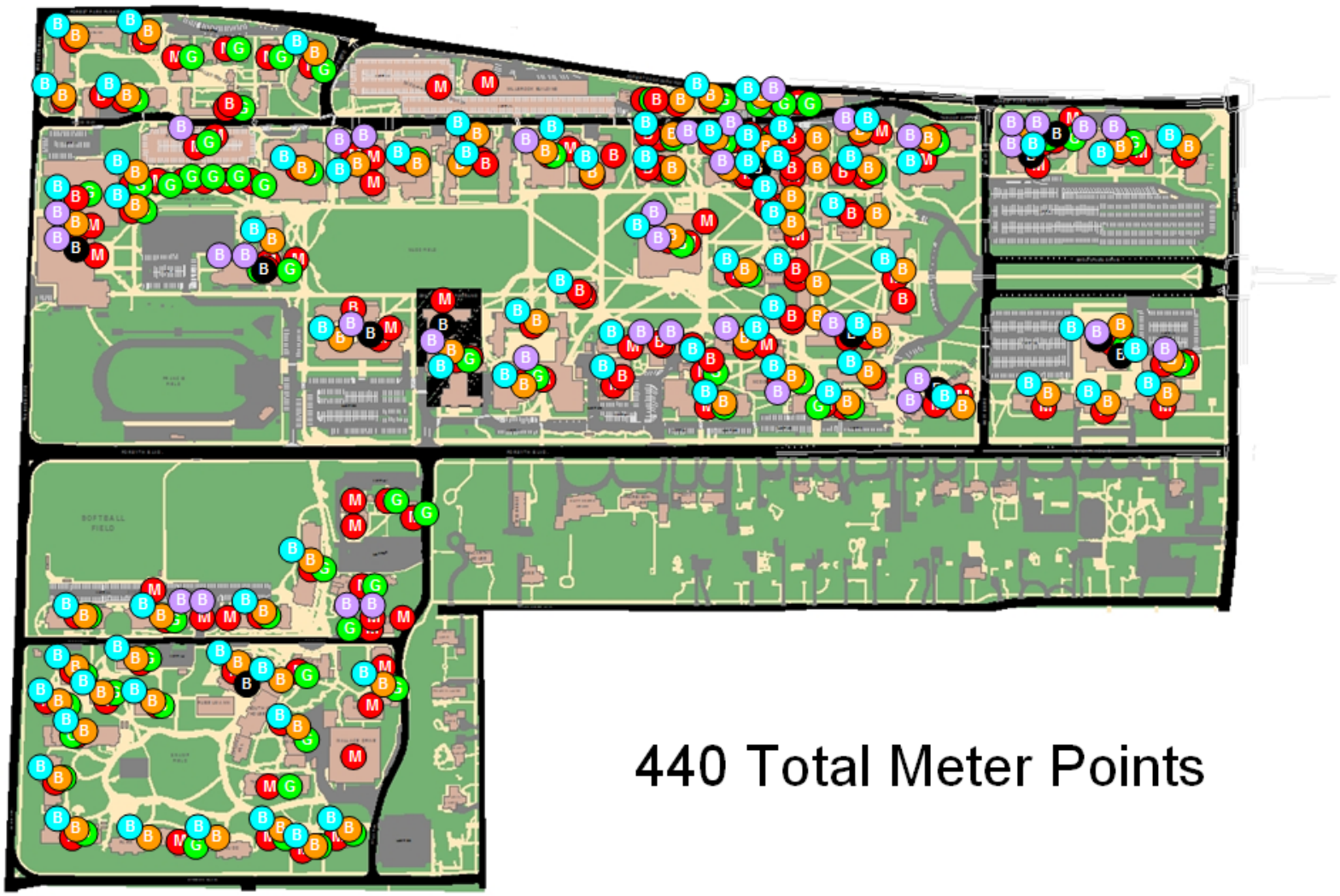
Allows us to:

- Quickly flag and correct inefficiencies
- Identify unusually inefficient buildings to target for energy conservation projects
- Support incentive programs to encourage users to conserve energy
- Verify that new construction and energy efficiency projects are operating as designed

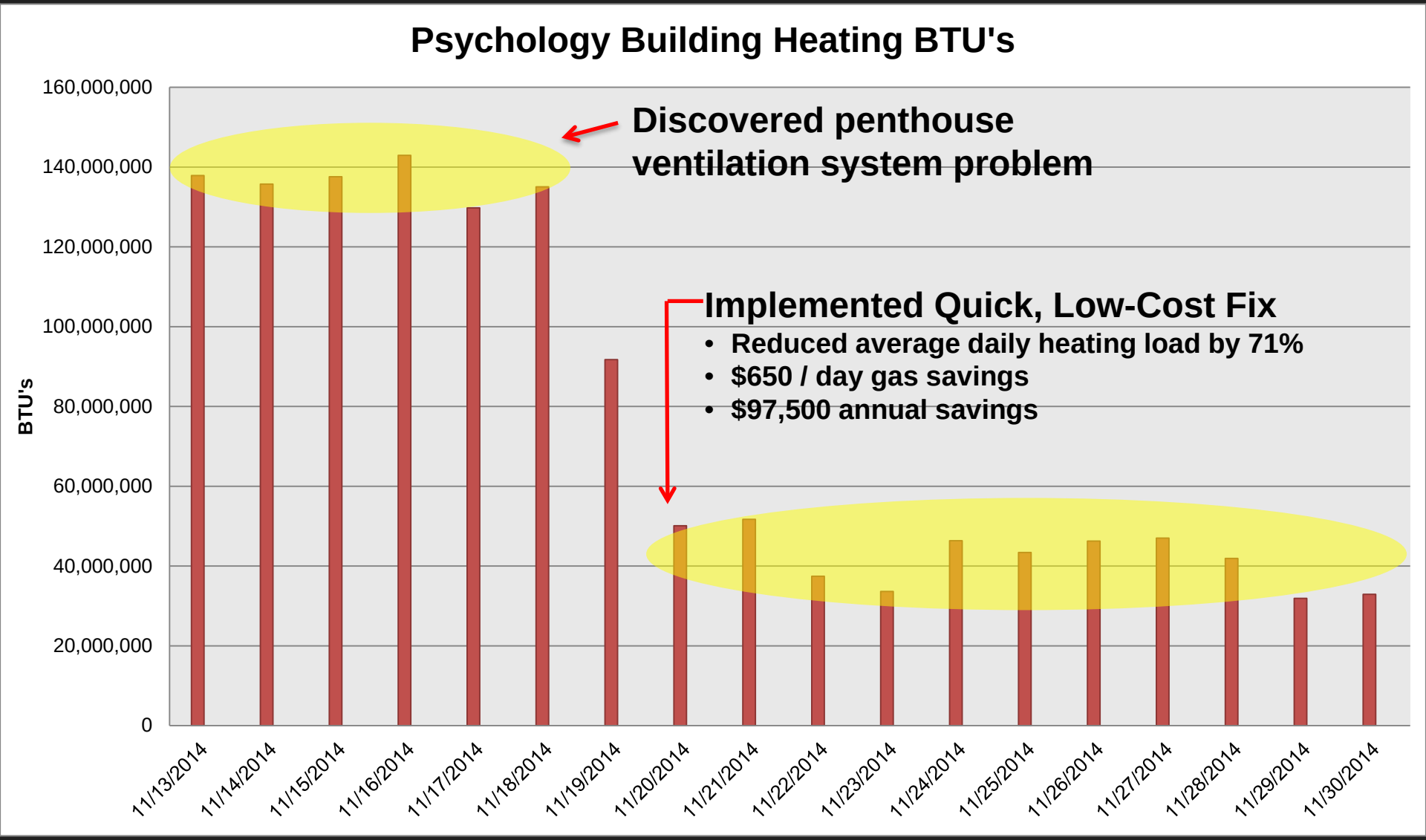
Campus Energy Supply



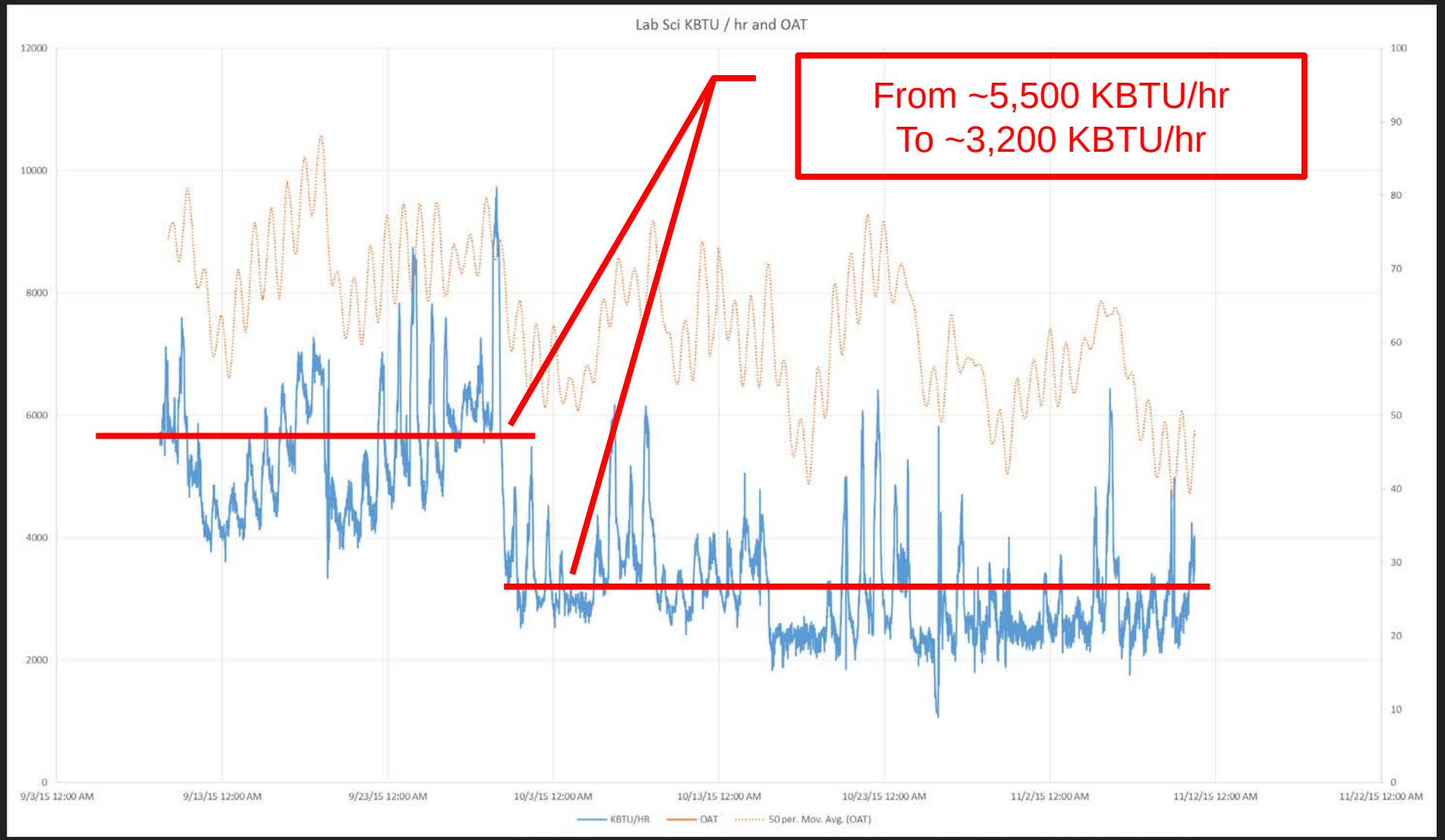
Total Meter Points



Meters – Flag and Correct Anomalies

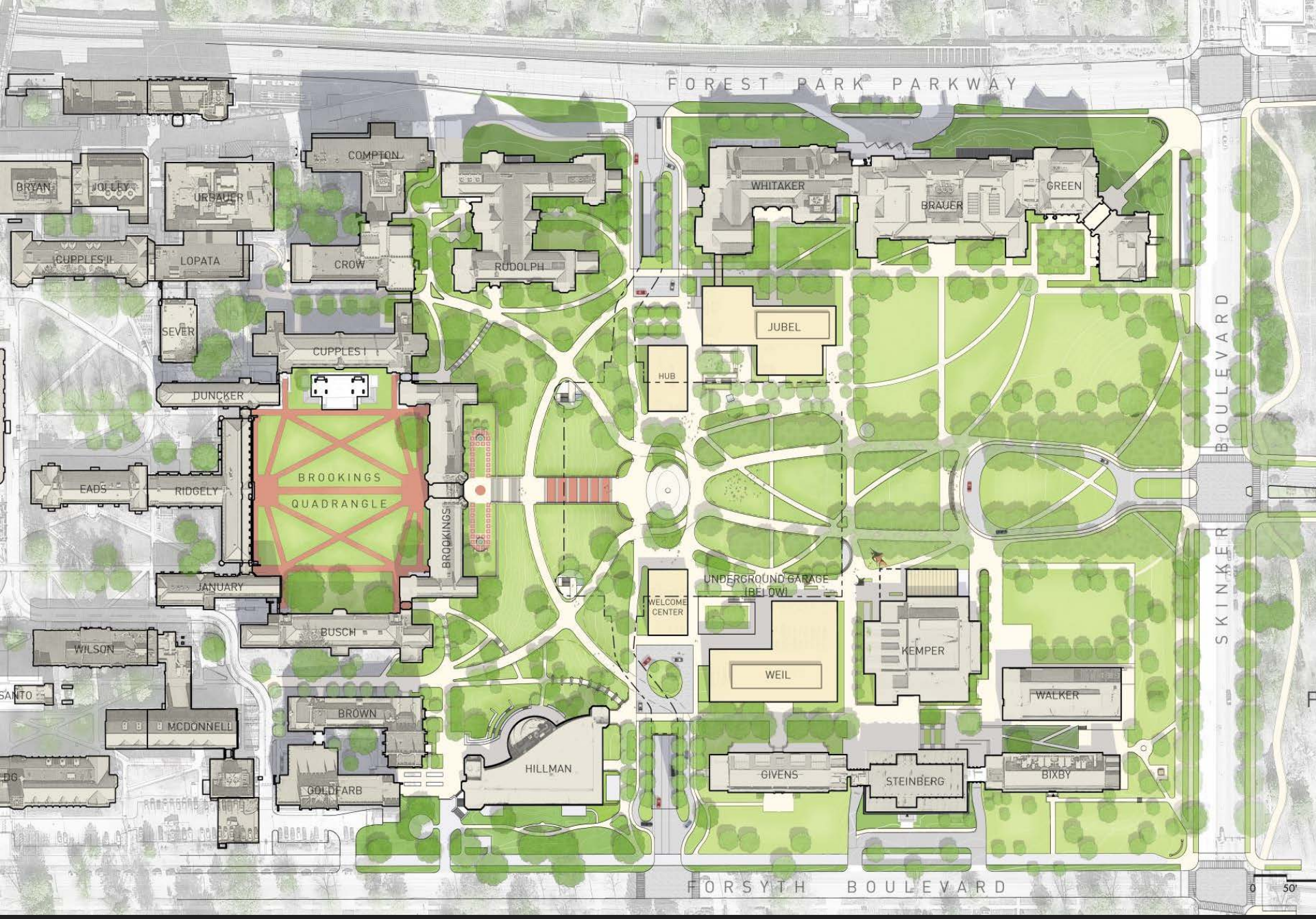


Validate Retro-Commissioning Results



Exploring Next Generation Low-Carbon Energy Systems

Enhancements to the East End of the Danforth Campus



Washington University in St. Louis

View of Central Green and Brookings Allée

Washington University in St. Louis

Continue to Push the Envelope On-Campus

EAST CAMPUS PLAN
DRAFT

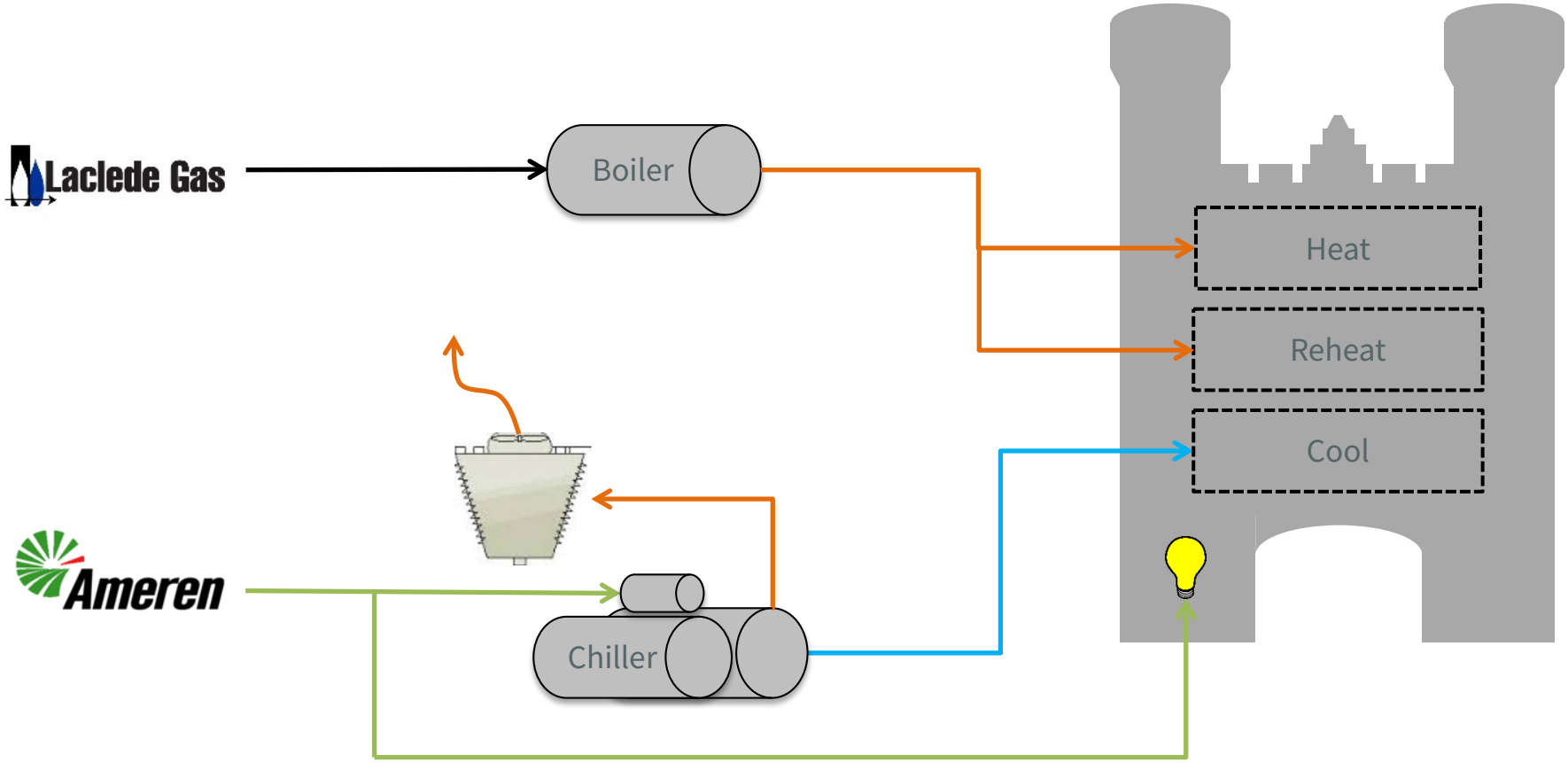
Sustainability Strategies

The East Campus Plan includes many sustainable strategies that integrate the 2015 (draft) Strategic Plan for Sustainability as well as current university standards. It also pushes performance to the next level in areas where there will be a reasonable payback when following the university's financial modeling guidelines.

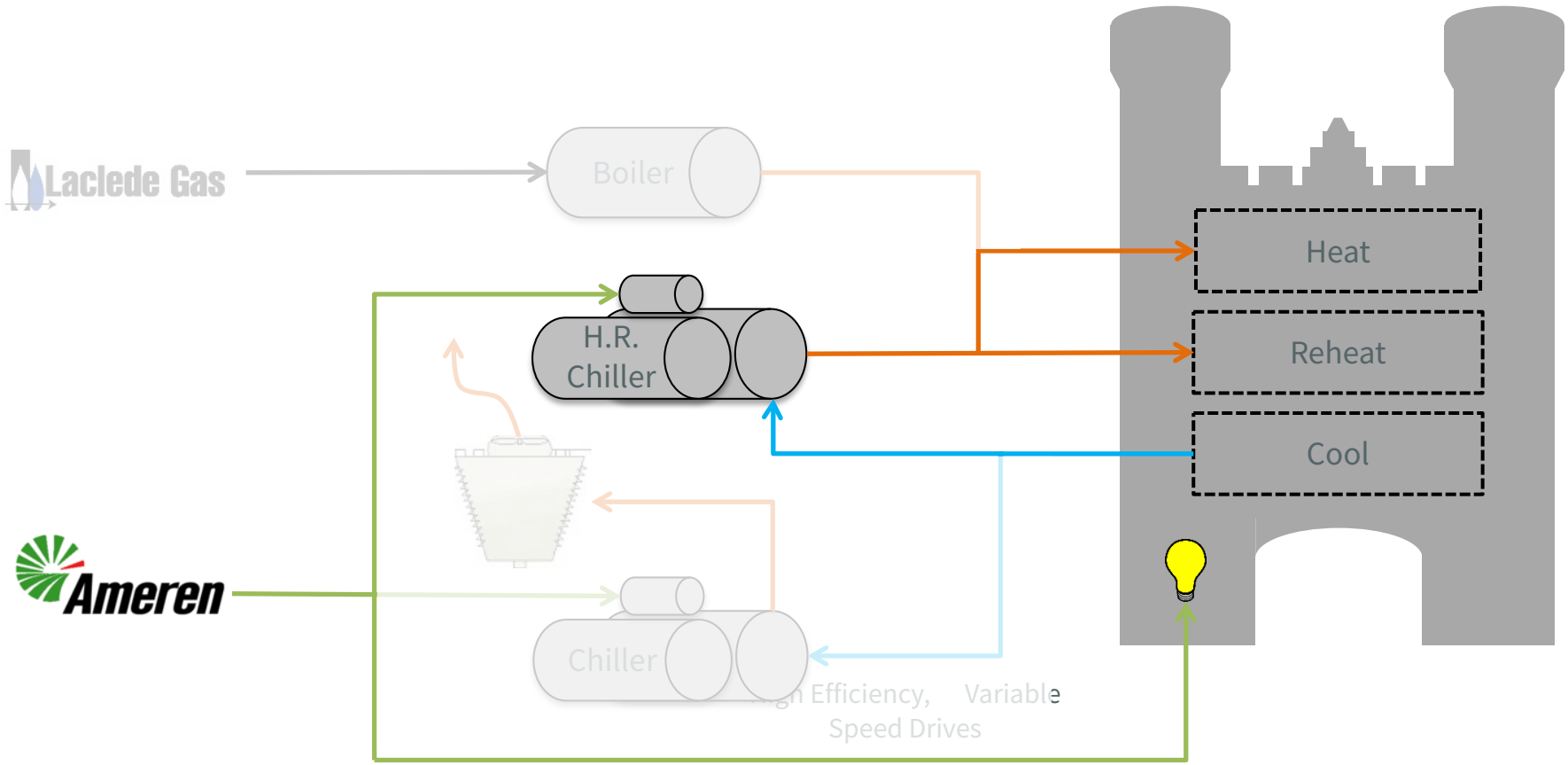
The graphic to the right depicts some of the physical strategies that have been incorporated into the East Campus Plan and its respective budget. These are keyed to the opposite page's list of sustainability strategies by focus area.

There are several infrastructural opportunities in the areas of energy and water that have been identified for further investigation. Further study needs to be conducted to prove these strategies have a greater return on investment and/or provide a positive impact on the community.

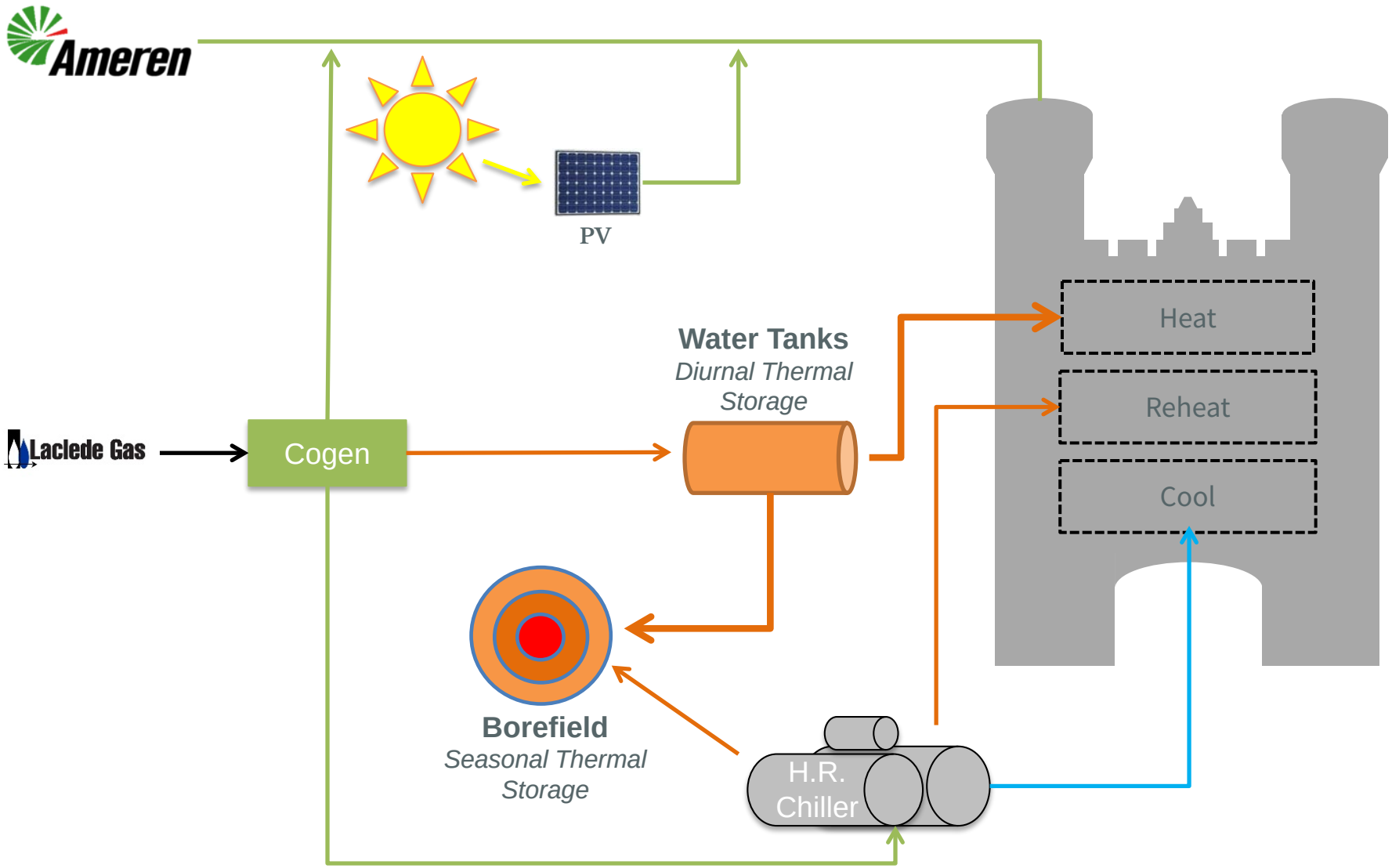
Industry Standard Heating and Cooling



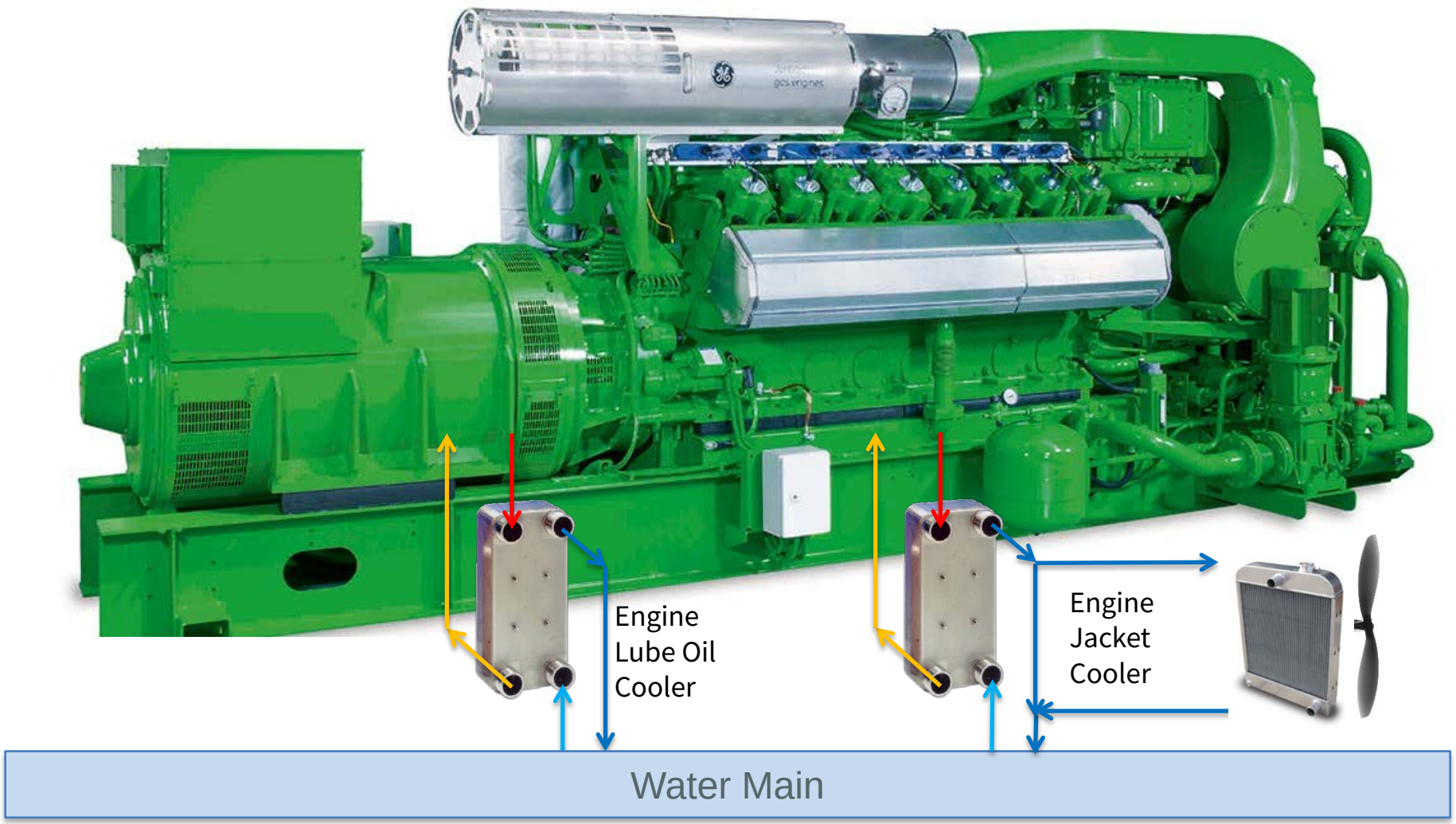
WUSTL Standard Heating and Cooling



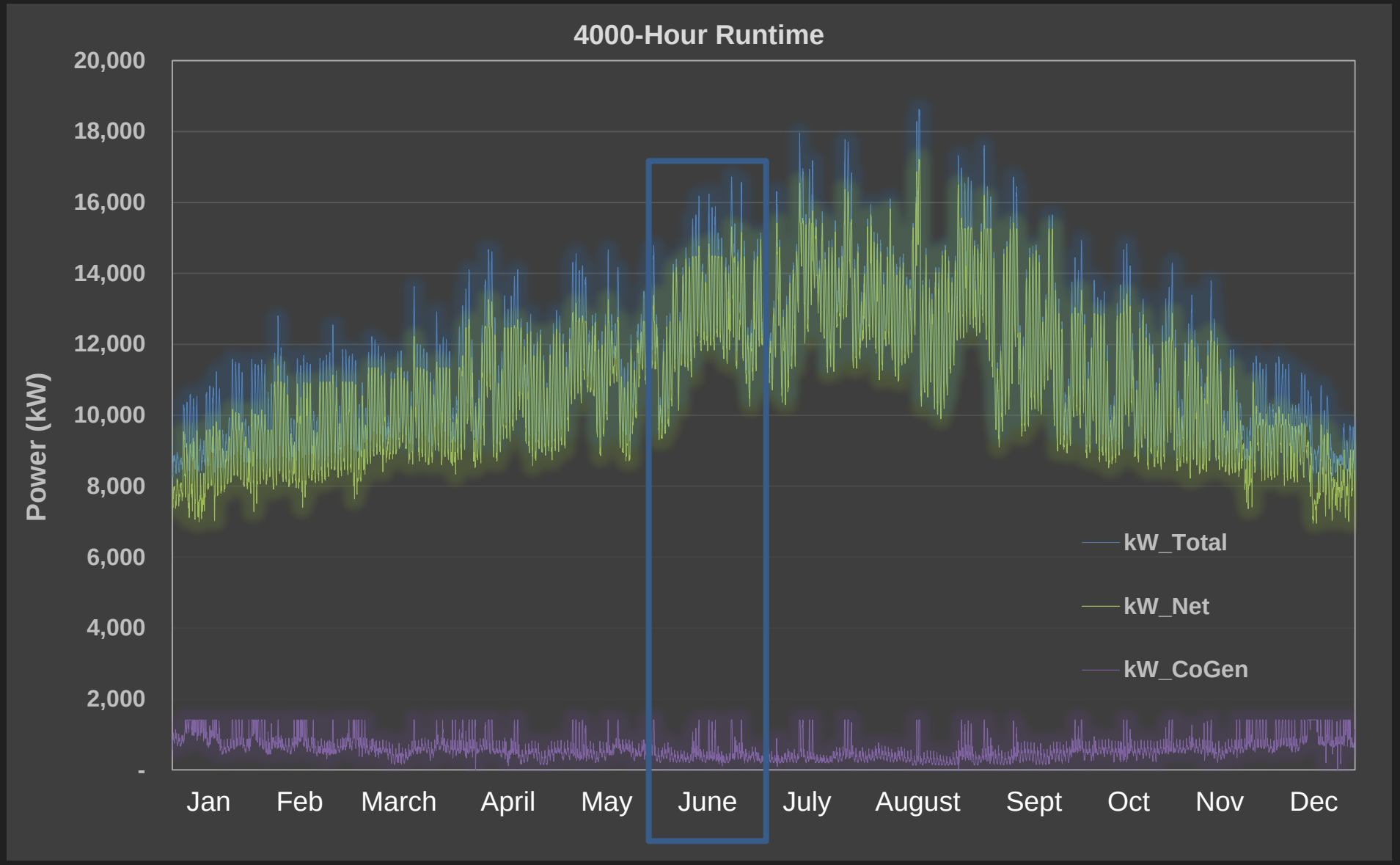
Proposed Renewable District Energy System



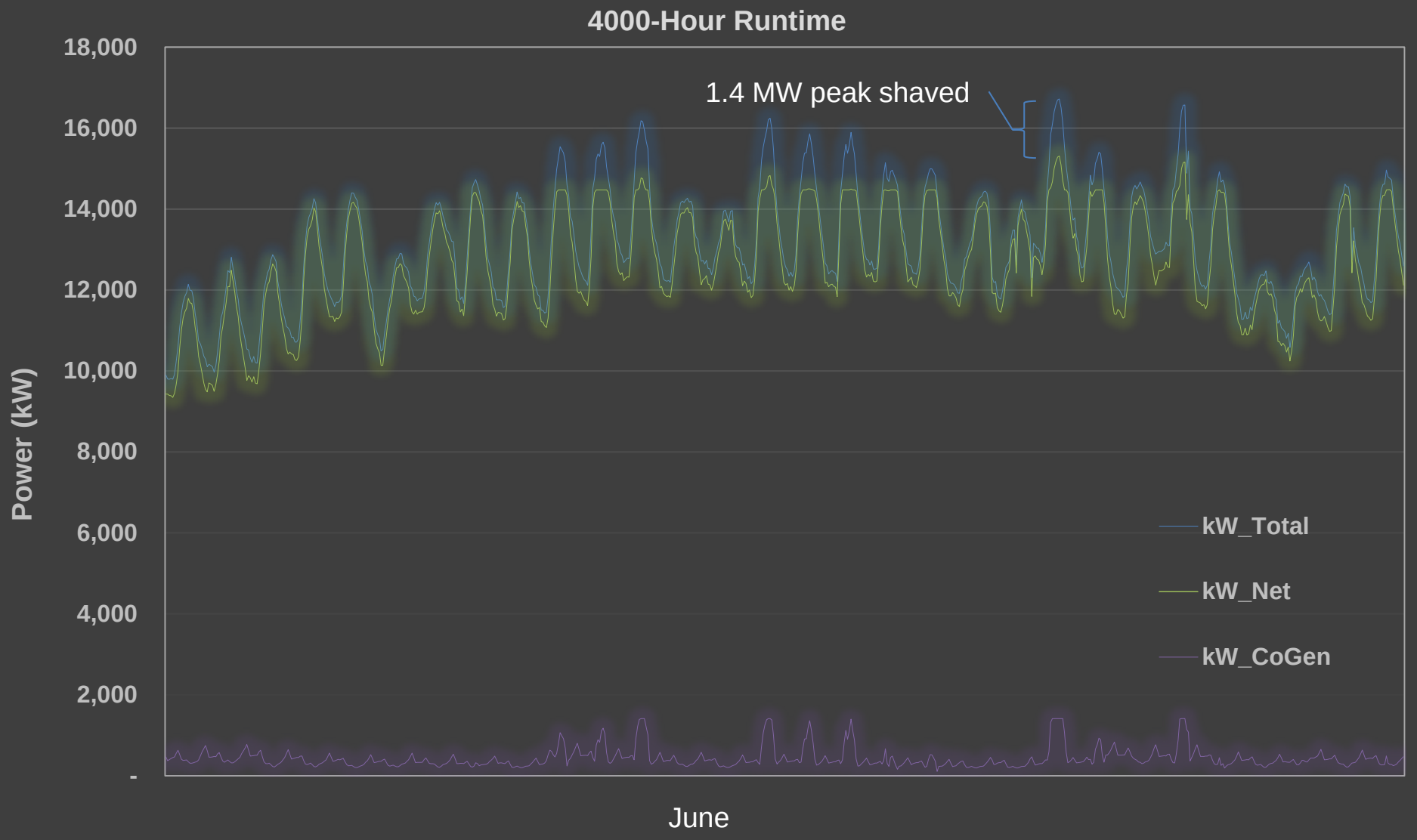
CHP – 1.4 MW Reciprocating Engine



CHP Peak Shaving Potential



CHP Peak Shaving Potential



Completed Feasibility Study for Second CHP

4.3 MW CHP turbine was found to be feasible for School of Medicine campus.

Energy Efficiency Incentive and CHP

Develop and publish the rules for evaluating and valuing CHP projects under the EE incentive program.

CHP projects have long development time horizons. Any EE incentive for CHP should take this into account and provide a solution for projects that bridge EE program cycles.

Evaluating our options.

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Sustainability

Washington University in St. Louis