

Energy Efficiency in a Connected Community

EE Technologies: Reducing Carbon Now and in the Future



A Comprehensive Approach To Energy Management – Ohio Stąte University

System Operations

- Ohio State received upfront payment in exchange for a 50-year lease agreement on the following utility systems:
 - Electricity
 - Chilled Water / Cooling
 - Steam / Heating
 - Natural Gas
 - Geothermal

Energy Supply

- Ohio State Energy Partners (OSEP) works to enhance Ohio State's effectiveness in the procurement process for electricity, natural gas and other energy sources
- The University continues to buy directly from providers, and Ohio State continues to determine its priorities in terms of sources

THE OHIO STATE UNIVERSITY



System Design

 Partnership allows and promotes wholistic approach to energy infrastructure design to support sustainable campus development

Sustainability

- Focus on Columbus campus (485 buildings)
 - Guaranteed minimum 25% energy use reduction over 10-years with estimated capital need \$250M
- Potential to include regional campuses & other facilities
- OSEP required to deploy smart meters to the entire Columbus campus at no cost to Ohio State

Academic Collaboration

- \$50M for new Energy Innovation Center
- \$25M for student financial aid
- 500 internships (\$5M)
- \$20M for sustainability curriculum, staff development
- \$9.5M for five faculty positions
- \$40.5M for philanthropy



Campus Statistics – A Small City

Footprint & Energy Profile

- 490 buildings on ≈ 2,000 acres
- 100,000 people daily
- 1,300 hospital beds
- 14,000+ student residence beds
- 3 stadiums = 120,000 seats
- Elect., gas, steam, chilled water
- 110 MW peak demand
- 2.9 million MMBtu of steam
- \$115 million annual spend
- High reliability requirements





District energy systems on campus

Physical infrastructure of the Utility System



• Electrical Ductbanks = 188,470 LF = 35.7 Miles



A Smart, Connected Campus





Smart metering for smart buildings and a smart utility





Energy use in buildings and system monitoring





Energy conservation measures

Benchmarking + Energy Analytics

- How does the building perform relative to others?
- Where is the energy going?

Identify Strategies for Energy Reduction

- Switch Source Energy
- Replace Heating/Cooling/Power Equipment
- Convert Heating Distribution System
- Reduce Energy Consumption at End User
- Find all potential solutions
- Execute an integrated project

This illustrates the proposed ECMs at PRB. These measures were not designed in silos, but in a holistic manner to deliver one coherent, integrated project for the University.





Energy conservation program

Energy Use Intensity (BTU/ sqft) at Campus Level: Energy Use Intensity reduction Maximum budget: \$250M Minimum reduction: 25% 40% 30% 20% 13.1% 10% 0% 3 5 6 2 4 Year Contract — Target — Actual

9

Projects in progress/ completed

Deadline: 2027

- Plant Level
 - Steam to Heating Hot Water conversion with Heat Recovery Chillers
 - Geothermal expansion with additional heat pump
 - Chilled Water network consolidation
 - Campus Exterior Lighting upgrades with Wi-Fi coverage
- **Building Level**
 - Controls Optimization
 - Lighting Upgrades
 - VFD Installations
 - **Bi-Polar Ionization**

35%

25%

8

9

10



US DOE Program – Connected Communities

FOA

 On October 13, 2020, the U.S. Department of Energy (DOE) announced up to \$65 million in funding through its Connected Communities funding opportunity announcement (FOA) to expand DOE's network of gridinteractive efficient building communities nationwide.

DOE Goals

- Show how buildings can reliably and cost-effectively serve as grid assets
- Decreased time and disruption for set up
- Increased insights on occupant impact, comfort, willingness to change timing of energy use
- New business models for demand flexibility and DER coordination, aggregation and optimization
- Online solutions portal with case studies, best practices, analysis and associated analytical tools



https://www.energy.gov/eere/buildings/grid-interactive-efficient-buildings



US DOE Program – Connected Communities

Connected Community: automated **BU**ilding Control with Knowledge of distributed EnergY resources and Electrical Systems for Grid Offerings (BUCKEYES GO!)

Prime recipient: Ohio State (PI: Michael Hagenberger); Subrecipients/KPs from ENGIE, NREL, UC-Berkeley

Summary

20 centrally connected and controlled **buildings** (10 MW peak demand), 65k ft² photovoltaics, 29 EV charging stations, combined heat and power plant & co-located central chiller plant.

Demonstrate **automated**, **secure community-level energy and demand management to provide economic and environmental value** to asset owners (Ohio State), operators (ENGIE) and grid partners (PJM & AEP) while maintaining or improving occupant experience.

Baseline and Targets

- Energy Efficiency: 35% energy reduction
- **Demand Flexibility** >2 MW flexibility at peak times
- Asset Value: 20% increase in NPV of renewable assets (vs 2019)

Impacts

- Sustainable value streams for owners, operators, occupants, and grid operators
- Replicable operations & business templates
- Al-driven, automated control software
- **Template for renewable integration** in solar & wind-poor, natural gas-rich Midwest PJM service territory

Key Takeaway Uniquely qualified team piloting template for rapid transition to renewables in one of US's most difficult regions



Project Concept: Automate It! AI BASED SOFTWARE CAN CREATE VALUE AT MULTIPLE POINTS ON





Big Picture Timeline – 5 Year Project Horizon





Energy Advancement and Innovation Center

- A platform for Ohio State faculty members, students, alumni, local entrepreneurs and industry experts to work together on the next generation of **smart energy systems**, **artificial intelligence**, **renewable energy** and **green mobility solutions**.
- The 66,000-square-foot building will prioritize strategies to reduce energy usage. The project will include the installation of a direct current (DC) microgrid with future plans to install photovoltaics/solar panels on the roof.
- Groundbreaking was November 12th, 2021.
- Facility slated to open in the Fall of 2023.
- Total project budget of \$48.4M.













A Connected Community for Energy Optimization





Energy Efficiency in a Connected Community

Thank you for your interest