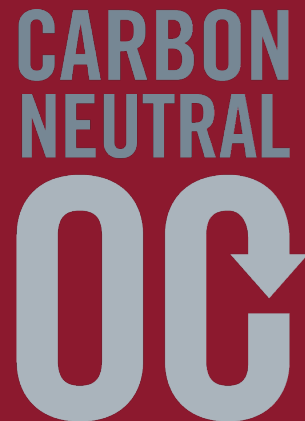


Sustainable Infrastructure Program

Next Steps to Carbon Neutrality

September 2022



College Commitment & Culture



- **Our Commitments:** Oberlin College has established a very aggressive climate action plan with greenhouse gas reduction targets of 100% by 2025.
- **Our Environmental Policy:** The policy states, “The core mission of Oberlin College is the education of its students. One aspect of such education is the demonstration by its actions of the College's concern for, and protection of, its physical environment.”
- **One Oberlin Strategic Effort:** Develop a roadmap to financial resiliency.

Getting to Today

- Oberlin's History of Environmentalism and Action
- 1992-1993 David Orr's Architecture as Pedagogy
- What has traditional educational architecture has taught previously:

Undesirable lessons about the human relationship with the natural environment.

Energy is cheap and infinitely available

Environmental costs of construction and operation are not important

Place is not important



Building Beginnings

- Past before Present
- First Ecologically Designed Academic Building
 - Adam Joseph Lewis Center for Environmental Studies

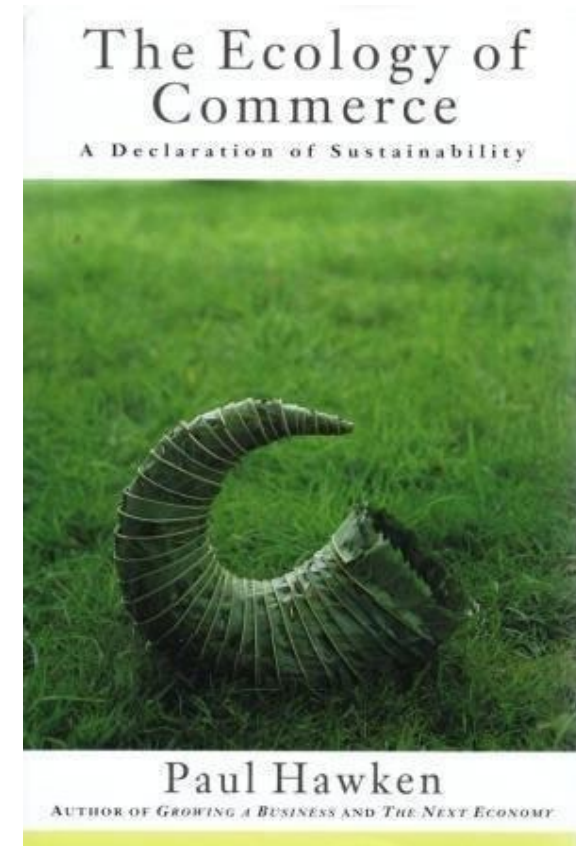


Could you build a building that ...

- Basic Principles that evolved into the design ethic
 - “To aim for a building and landscape that would cause no ugliness, human or ecological, somewhere else or at some later time.”
 - “Can you build a building that behaves like a tree?”
- Can you build a building that adheres to natural law?
 - William McDonough – Charlottesville, VA
 - Buildings Like Trees, Cities Like Forests (2002)

Natural Law to Building Systems

- I use Paul Hawken's definition, laid out in *Ecology of Commerce* (1993).
- Three fundamental principles that govern nature.
 - Nature runs off current solar income
 - Waste = Food
 - Nature depends of diversity
- I add one more: ecosystems utilize feedback to govern decision-making
- How does this design ethic translate to the AJLC?



Recently Harvested Solar Income

- 59 kW curved array
 - November 2000
 - 690 x 85W BP Solar
- 101 kW parking lot array
 - May 2006
 - 336 x 300W Schott
- What does it run?

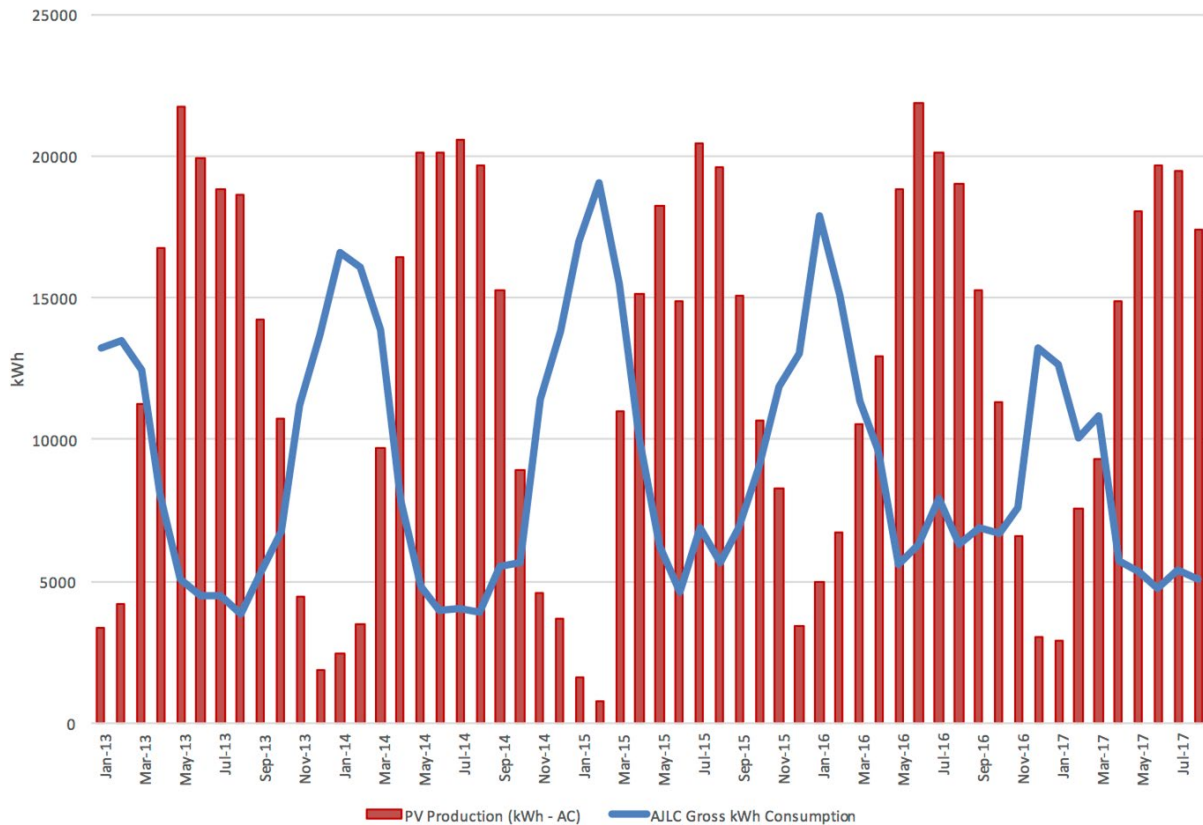


HVAC System

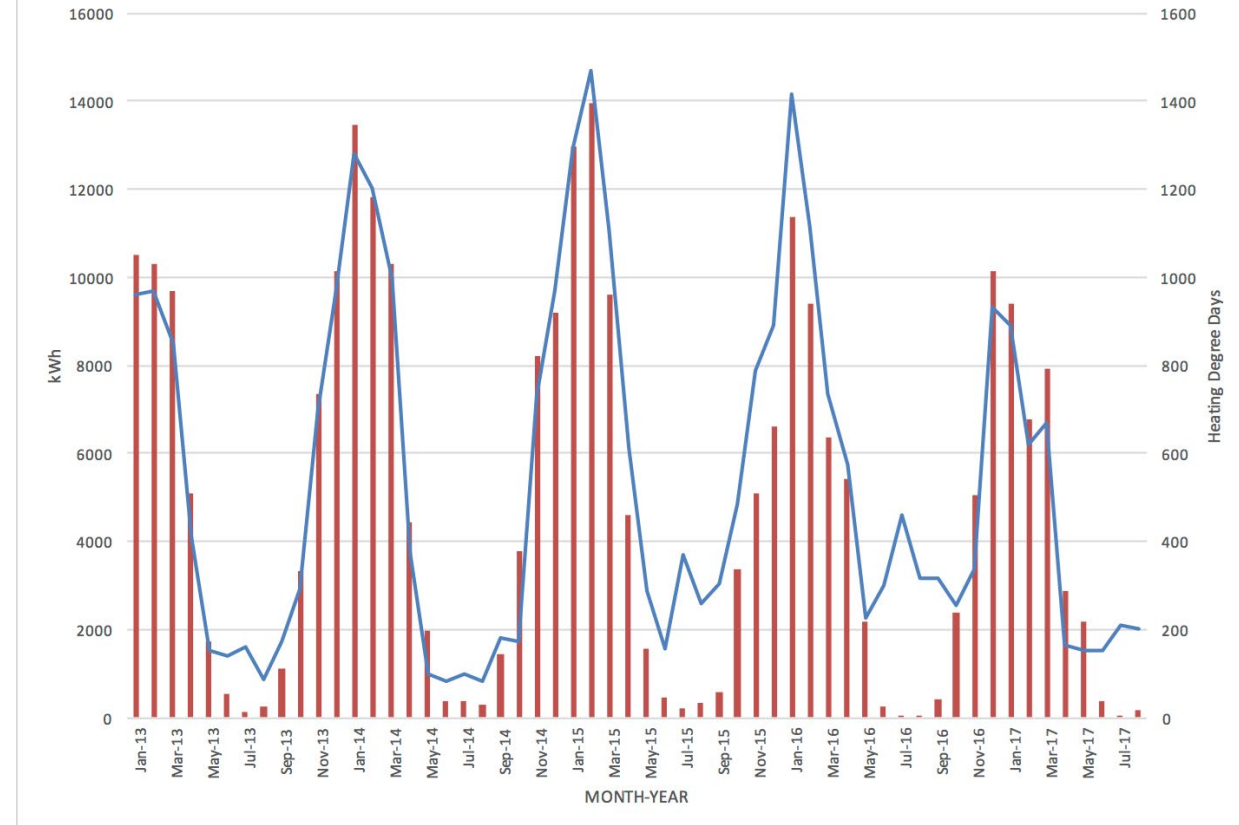
- AJLC is all electric
- Geo-exchange system
 - 24 wells
 - 240' deep
 - Supply water temps vary from 38° to 55° and averages 51°
 - 27 distributed Carrier heat pumps
 - 2 large (10 ton and 6.5 ton)
 - Fresh air and large spaces
 - 2 water-to-water
 - Floor Radiant & Hydronic System
 - 23 ½, ¾, or 1 ton units for offices and classrooms
- Other Components
 - VFD for source water pump
 - 2 Energy Recovery Ventilators
 - Motion and CO₂ sensors determine occupancy
 - Motorized window openers
 - Integrated into a Siemens Control setup
 - Large spaces use calendar scheduling
 - Small spaces use occupancy
 - OPER Overrides
 - Challenges

Graphs of Interest

AJLC Energy Consumption vs. PV Production



HVAC Loads vs. HDD



Waste = Food

- Living Machine

- Waste is a purely human construct.
- In nature, all outputs serve as inputs to some other system.
 - Process every drop on-site
 - 30-50k GPY
 - Produce a safe and quality effluent that could be recycled as flush water
 - Provide research opportunities for students and faculty



Biodiversity Trumps Homogeneity

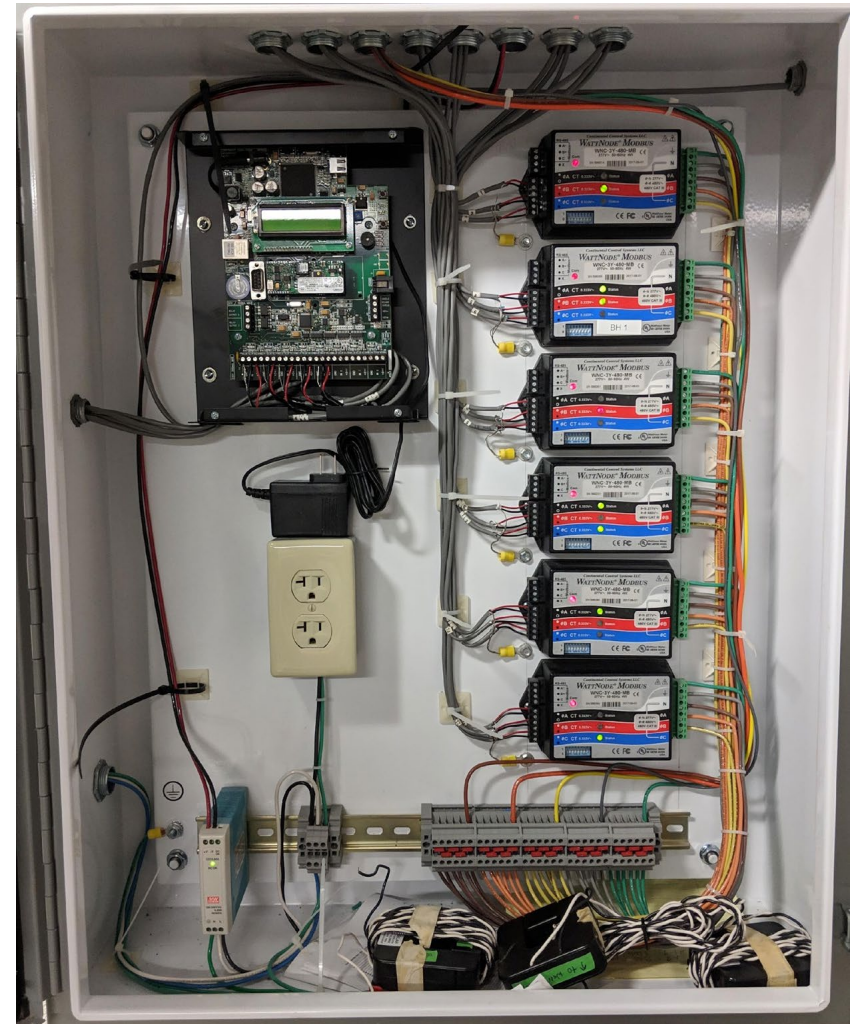
- **Literal**

- External Landscape
- Species selection
- Natural v. Engineered
- Wetland & Pond v. Living Machine
- Food Production System
 - Orchard, Garden, Hazelnuts



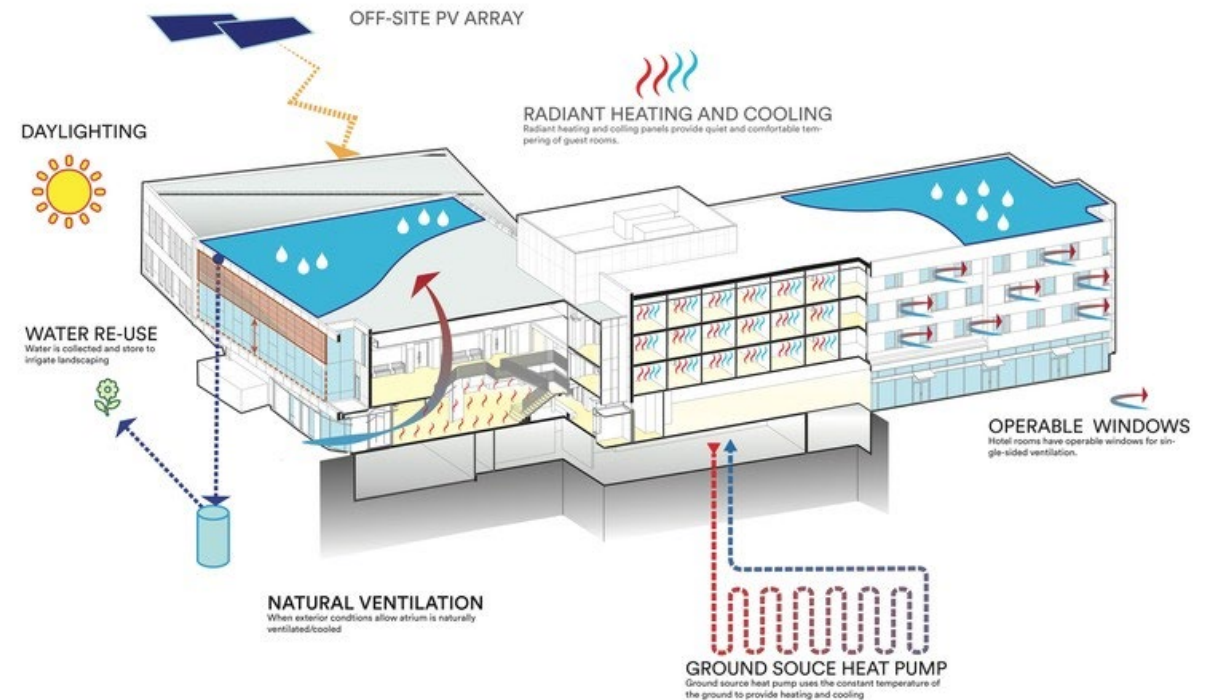
Organisms Utilize Feedback for Decision Making

- In cooperation with NREL
 - Installed ~180 sensors
 - Covering all aspects of resource use and relevant information
 - Energy Consumption and Production
 - Water Consumption and Recycling
 - Temperatures
 - Environmental Conditions and Weather
 - Chemical Conditions



How the AJLC Influenced Oberlin

- Kohl Jazz Building
 - Ground-sourced heating and cooling
- Kahn Residence Hall
 - Building materials, solar PV, pedagogical focus
- The Hotel at Oberlin
 - Ground-sourced heating and cooling
 - Building materials, practices, and landscape

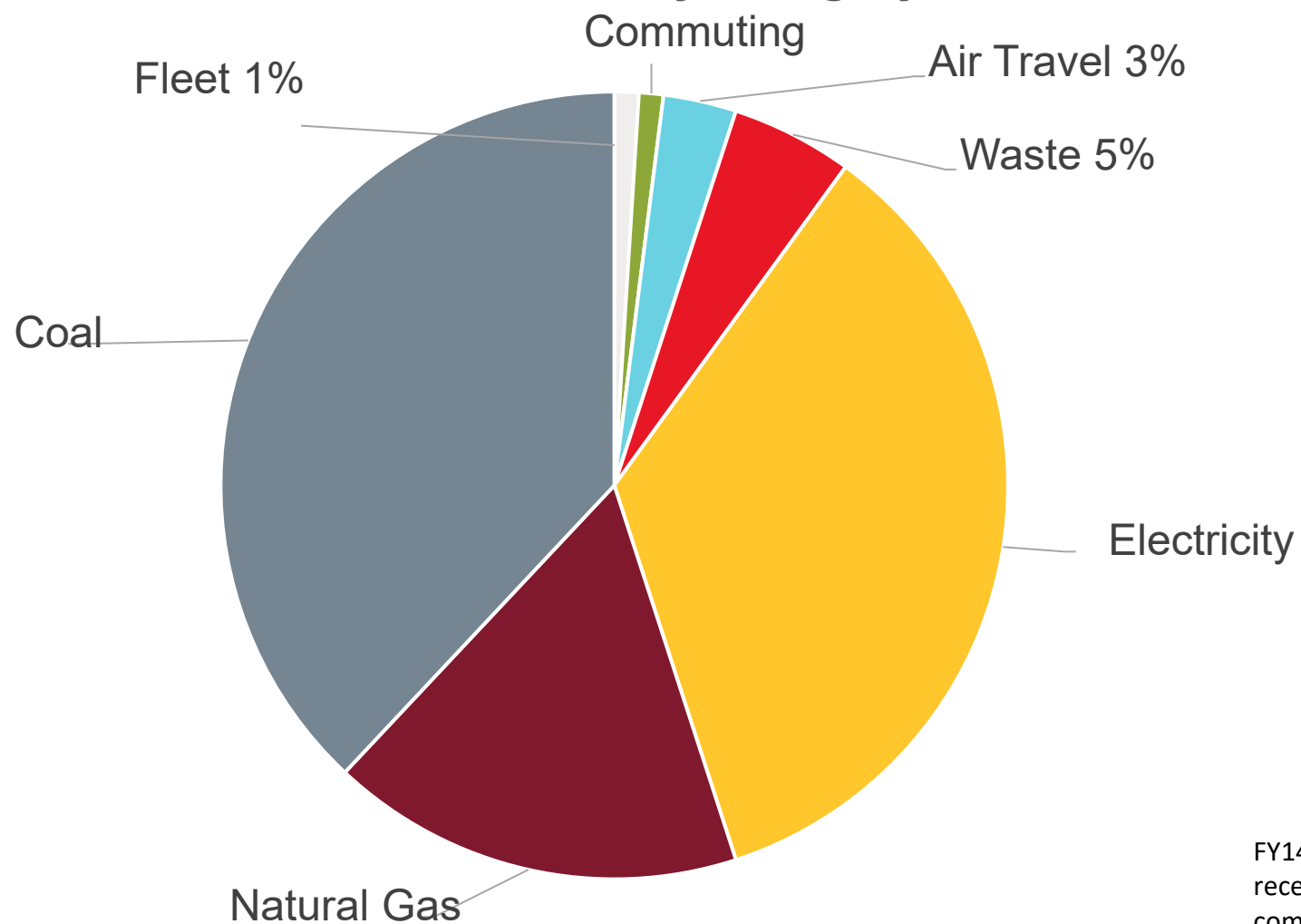


What's Next at Oberlin



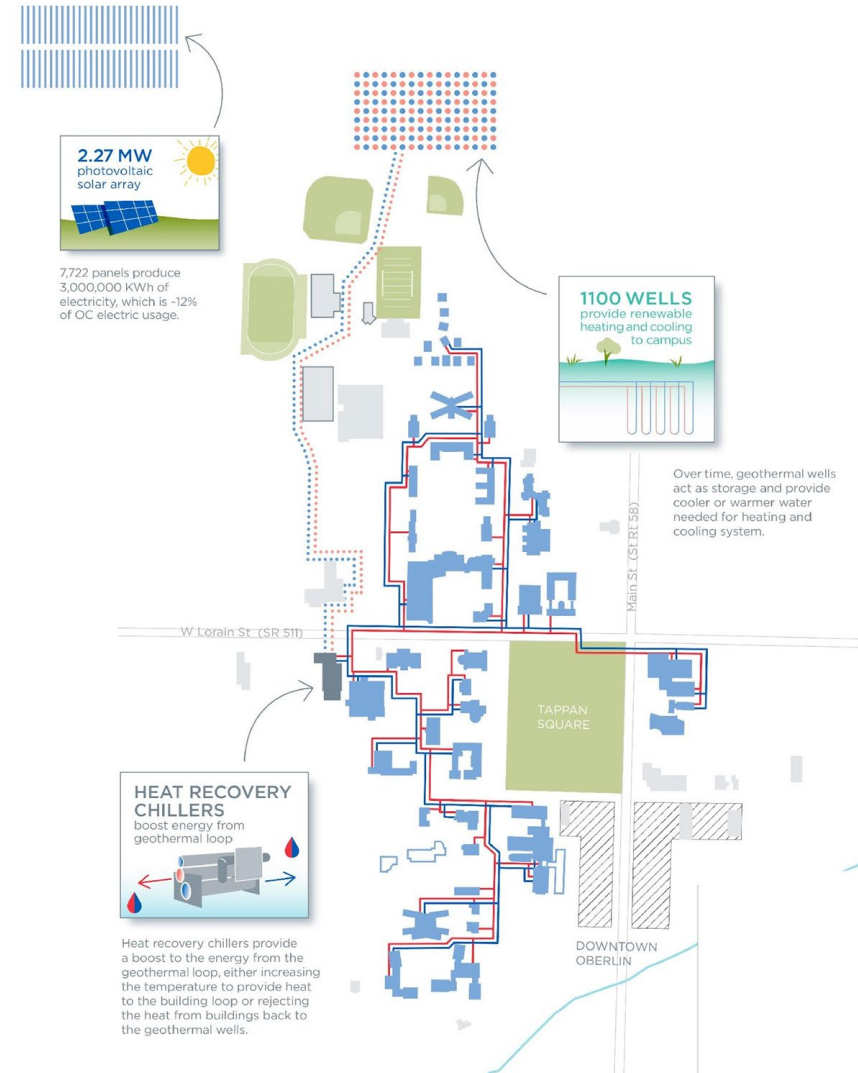
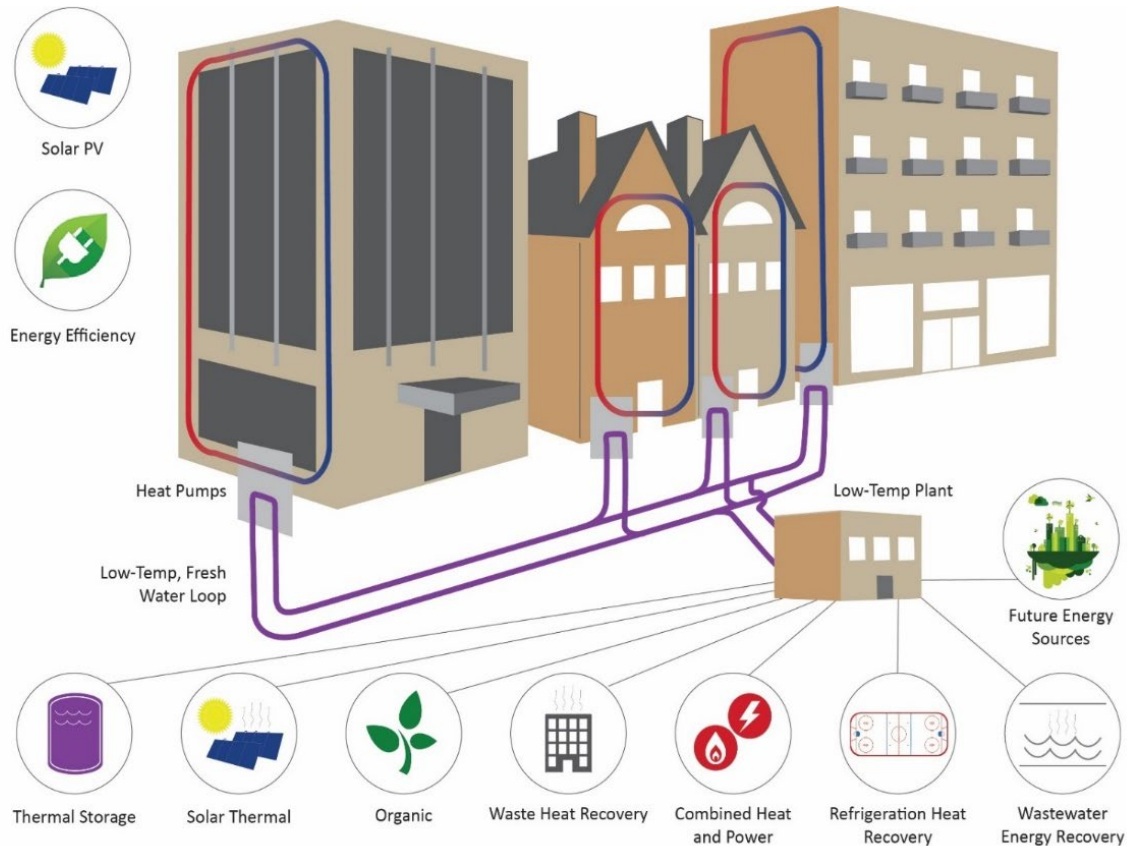
Heating has biggest impact to our carbon profile

CO2e Emissions by Category FY 2014



FY14 is the baseline year for when this recent resource planning work commenced

What is District Energy and How Does it serve Oberlin College?



Existing Steam System is Aged



Oberlin College's Call For Action

- **Antiquated Steam System**

The system is inefficient and past its useful life

Increasing emergency shutdown trend

- **Expanding Cooling Needs**

Changing school calendar

Summer Programming

- **Carbon Neutrality by 2025**

Steam system is the biggest contributor to carbon emissions

- **Broader Campus Utility Needs**

Fiber, Electrical Infrastructure, Fire Protection

- **Implementable and Financeable**

Business and organizational structure solution

Oberlin's Sustainable Infrastructure Program Goals & Priorities

- Operational Cost Savings
- Carbon Reduction
- Resilient and Reliable Systems
- Educational Benefit
- Community Benefit
- 2025 timeline
- Sustainably Financed

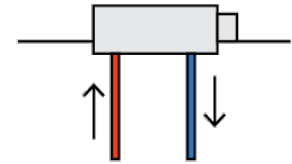


Evaluating all Carbon-Free Alternatives

- Aquifer Thermal Energy Storage
- Biofuel
- Biogas
- Biomass
- Geothermal
- Variable Refrigerant Flow (VRF)
- Waste heat capture from a local power plant
- Solar PV with electric resistance heat and thermal storage
- Wind with electric resistance heat and thermal storage



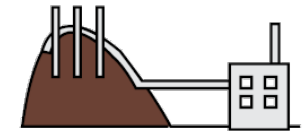
BIOGAS



GEOTHERMAL



BIOMASS



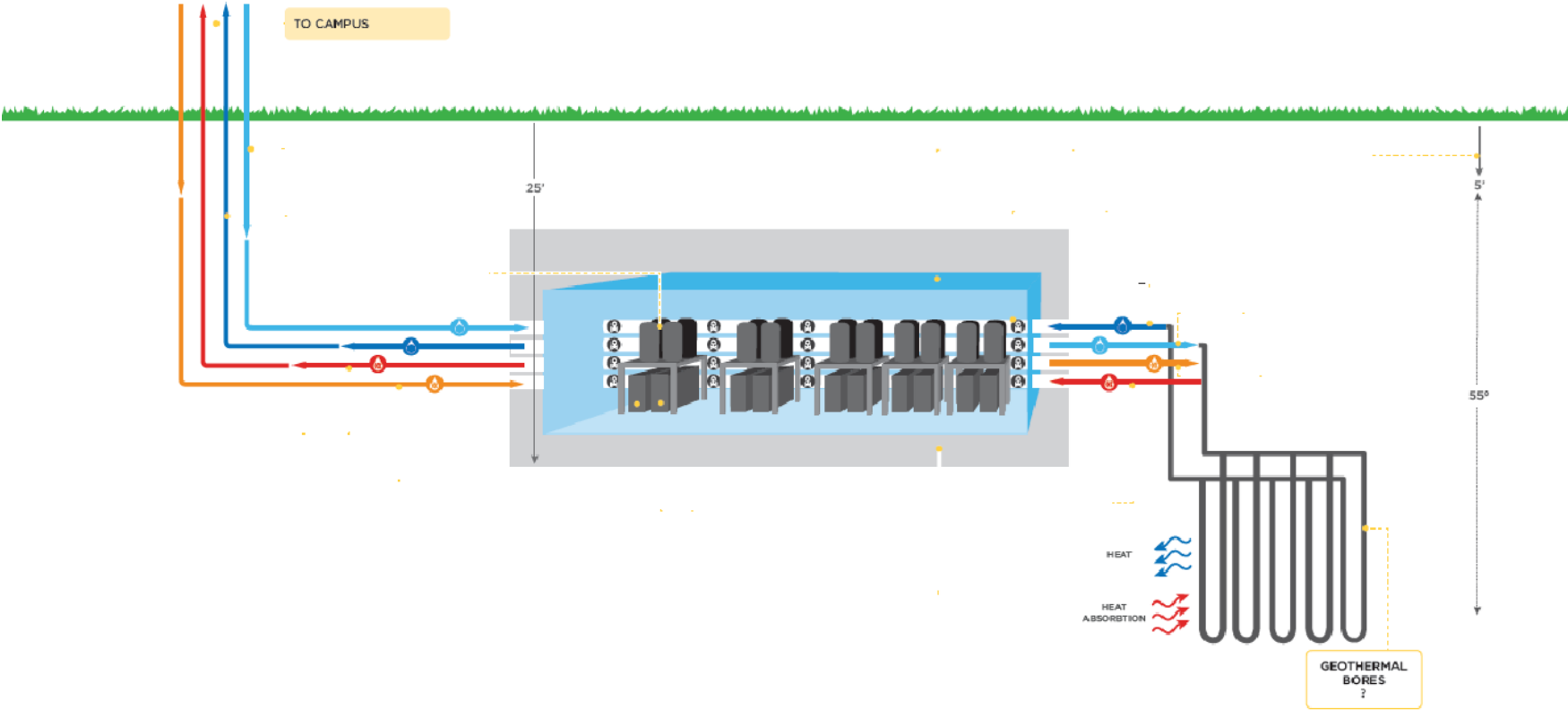
LANDFILL GAS COMBINED
HEAT & POWER

Oberlin's Sustainable Infrastructure Program

- \$80 Million Climate Certified Green Bonds initial funding
- Four construction phases 2021 - 2024
- Primary work during summer breaks
- Geothermal integration in 2023 and 2024
- Future growth into the community



Introduction to Geothermal Energy

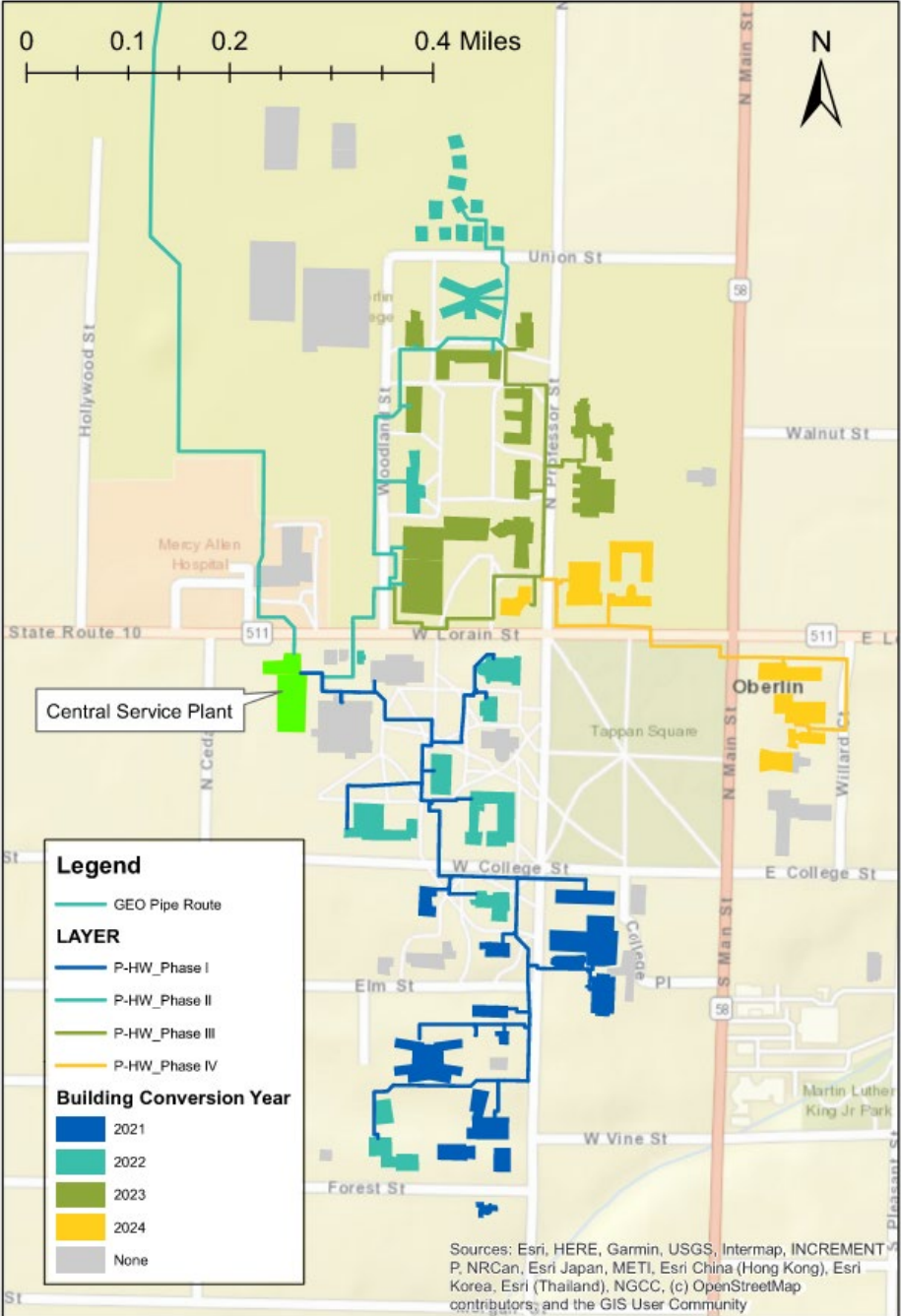


Geothermal Well Field

- Practice field disruption during construction
- Electrical infrastructure enhancement required at the central plant
- Finalized design progressing this summer & installation starting in 2023



4-Year Construction Plan



Phase I Financing

- \$80M of Climate-Certified Green Bonds
- 2nd higher-ed campus in the US to obtain this certification
- 5 basis point savings over non-certified bonds
- 3X oversubscribed
- Lowest cost of capital ever realized by the College

Oberlin College and Conservatory Secures \$80 Million in Certified Climate Bonds for Sustainable Infrastructure Program (SIP)

AUGUST 3, 2021 • Office of Communications



An aerial view of sustainable infrastructure work in Wilder Bowl.
Photo credit: William Bradford

- Bond enables Oberlin to initiate substantive progress on four-year project to build new geothermal energy system for the campus

Communications and Outreach

- Program website
- Weekly construction updates
- Project tours
- Knowledge sharing
- City and community engagement
- Program videos



Oberlin College's Sustainable Infrastructure Program

The Sustainable Infrastructure Program (SIP) is focused on upgrading the century-old heating infrastructure serving campus to a hot water system. This work will enable a large-scale geothermal system, add cooling to buildings, and implement other building improvements that will increase student and faculty comfort year-round. These improvements are the tangible outcomes of Oberlin's earlier commitments to the American College and University Presidents' Carbon Commitment and the 2025 carbon goal.

We celebrate the accomplishments from phase one of the project with the entire Oberlin community. In 2021, construction focused on South Campus where 13 buildings have been upgraded and nearly 25,000 linear feet of new heating and cooling pipe has been installed. Buildings that are fully converted to the new system are expected to be 30 percent more efficient. Additionally, these buildings will have local controls for greater occupancy comfort, expanded fiber networks, expanded fire protection capabilities, and upgraded mechanical and electrical systems. As the project progresses over the next three years, these improvements will extend throughout campus. [View photos](#) from phase one work.



Distribution work begins for phase 1 in Wilder Bowl

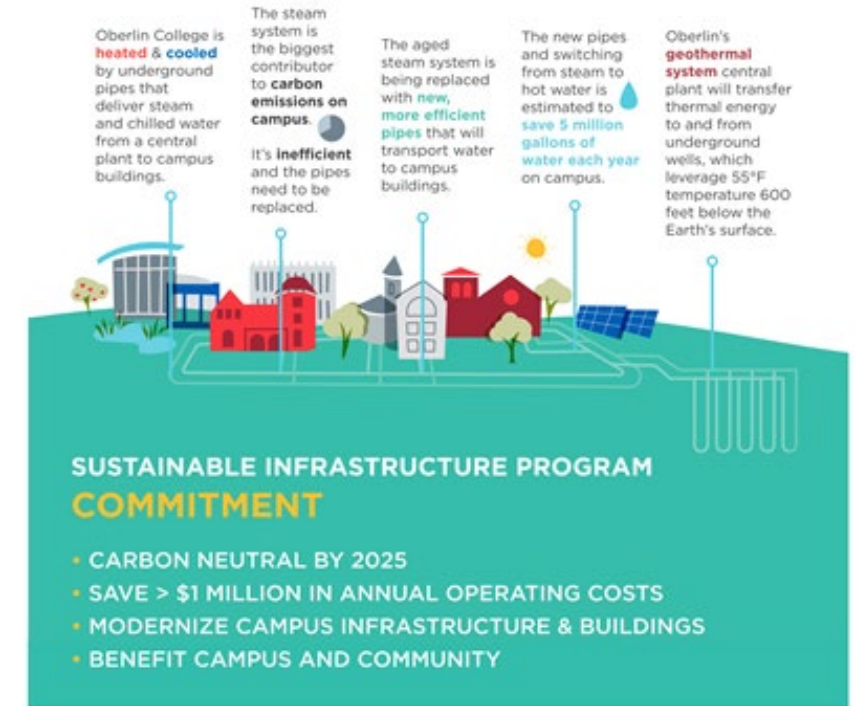
OBERLIN COLLEGE AND CONSERVATORY SECURES \$80 MILLION IN CERTIFIED CLIMATE BONDS FOR SUSTAINABLE INFRASTRUCTURE PROGRAM

Exciting news for the SIP initiative, this Bond enables Oberlin to take the next major steps on this four-year project to build the new energy infrastructure and geothermal energy system for the campus. The Certified Climate Bonds status verifies alignment with the goals and targets of the Paris Climate Agreement.

Becoming Oberlin's Mission

Bold vision. Big changes.

- Curriculum integration
- Internships and research
- Guest speaking in classes
- Tours: admission & parent weekend
- Diversity Equity Inclusion (DEI)
- Energy Dashboard
- 87.2% recycled construction waste
- Alumni connections
- Financial stewardship



CARBON NEUTRAL
OC



LEARN MORE AT
CarbonNeutral.Oberlin.edu

Achieving Carbon Neutrality at Oberlin College

Moves Oberlin College
within 11%
of the **carbon neutral goal**

Oberlin College is on track to be

100% by 2025
CARBON NEUTRAL

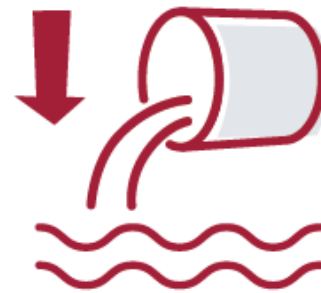
Over **\$1 million** in
annual operational savings

OC'S new energy system will:

Reduce campus
water use
by over
5 million
gallons per year



Reduce campus
sewer discharge
by over
4 million
gallons per year



Improve campus
energy efficiency
by more than



Questions?

CARBON
NEUTRAL
00 

The logo consists of the words "CARBON" and "NEUTRAL" stacked vertically in a bold, sans-serif font. Below them are the numbers "00" in a larger, bold font. To the right of the second "0" is a circular arrow icon, indicating a cycle or process.

CONTACT

For questions or to get involved, email us at carbonneutral@Oberlin.edu

Program Website: carbonneutral.Oberlin.edu

Biographical Information

#

Ben Hobbs, CEM
Adam Joseph Lewis Center
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bhobbs@oberlin.edu

Ben Hobbs is the Facility Manager for the Adam Joseph Lewis Center at Oberlin College. He joined the College in 2016 after a 10-year career teaching high school chemistry and environmental science and a two years in operations with a solar pv design/build firm. Ben is also a Certified Energy Manager and a Certified Educational Facilities Professional.

Joel Baetens. Campus Energy & Resource Manager
Office of Environmental Sustainability
Oberlin College
Service Building 209, Oberlin, OH 44074
440-775-5663 Joel.Baetens@oberlin.edu

Joel Baetens is the energy and resource senior manager in Oberlin's Office of Environmental Sustainability, having begun his duties in January 2020. He is a licensed PE and has more than 10 years' experience as an energy engineer.

He began his professional career as a project manager for a small non-profit in Ann Arbor, Michigan. At Clean Energy Coalition, he performed commercial energy assessments and helped businesses deploy biofuel infrastructure and renewable energy systems. Joel took the experiences he learned and pivoted his career to focus on higher education. He transitioned to Eastern Michigan University, where he managed the energy and utility systems.

Before coming to Oberlin, Joel was at Ohio University, where he worked on transitioning the heating plant from coal to natural gas and initiated procurement of renewable energy.

Joel lives in Oberlin with his wife, Jessica Minor-Baetens, who previously worked at the college and is well-versed in energy efficiency and sustainability, and their two children.

Education:

- BS, Electrical Engineering and Computer Engineering, Oakland University
- MS, Renewable and Clean Energy, University of Dayton