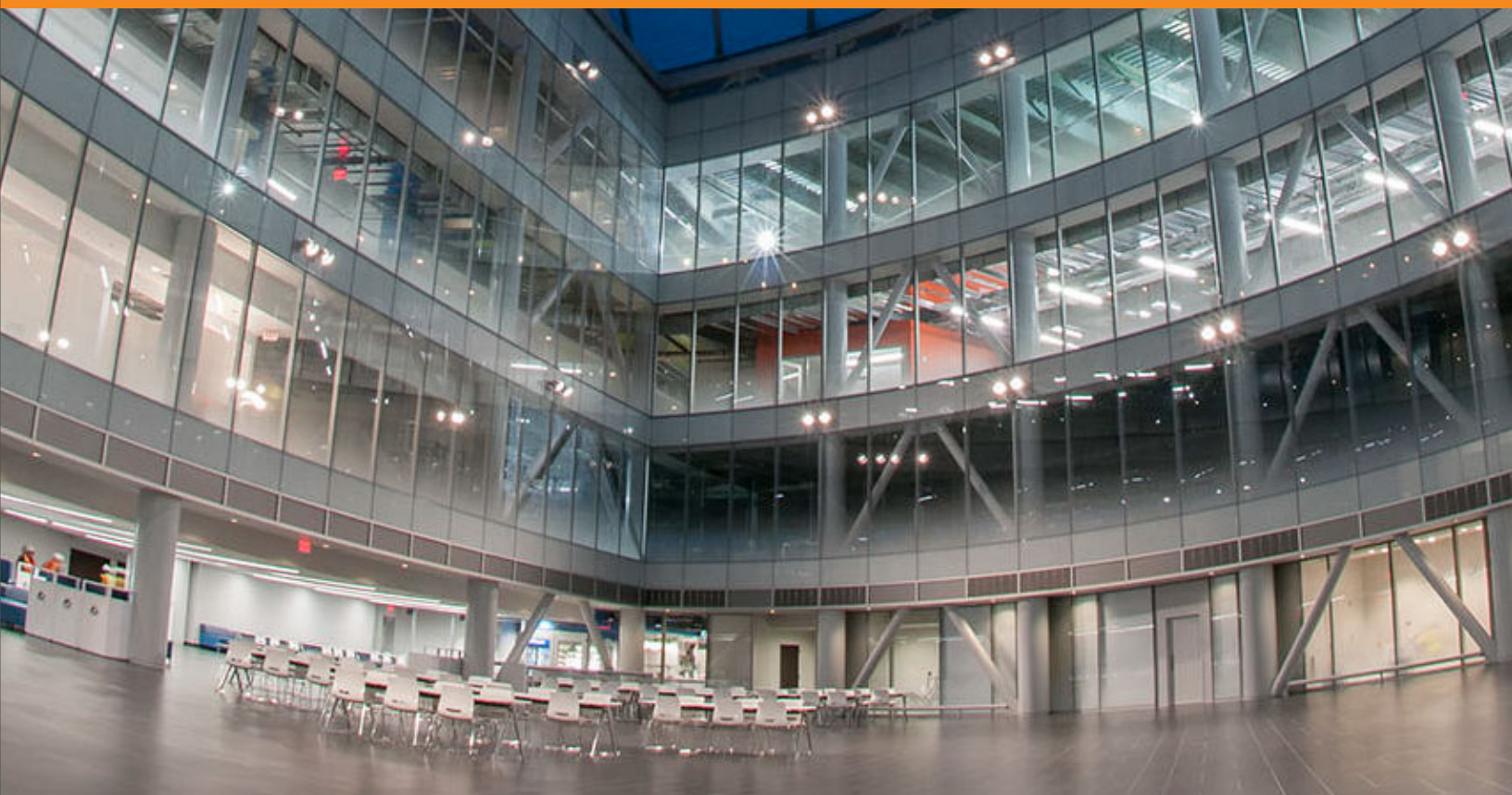
THE ZERO ENERGY NANOTECHNOLOGY BUILDING

Energy Solution by ReWire



THE ZERO ENERGY NANOTECHNOLOGY (ZEN) BUILDING

PROJECT OVERVIEW

The Zero Energy Nanotechnology (ZEN) building was conceived, designed, and built by SUNY Polytechnic Institute's College of Nanoscale Science and Engineering (CNSE), with the goal of net-zero energy performance through the use of various multi-system and multi-use applications.

The ZEN building is the largest zero-energy capable, mixed-use facility in the United States, incorporating the most advanced strategies regarding energy efficiency, renewable energy sources, and building operations. The Research Foundation of SUNY on behalf of CNSE entered into an agreement with NYSERDA in April 2013 to aid in the design of the ZEN building.

PROJECT GOALS

The design process had four main goals:

- Document the building design decision-making process
- Design an ultra-high-energy-efficient and cost-effective building
- Integrate the energy efficiency components and renewable energy systems
- Develop a flexible M&V strategy and M&V plan to be used for ongoing evaluation and optimization of net zero performance on an hourly basis

In 2022, the ReWire Group, LLC was hired to support the measurement and verification process of the ZEN building, collecting and verifying all deliverables resulting from “Tasks NYSERDA Agreement Number 30712” including:

- Advanced Fenestration Design
- Advanced Day Lighting Design
- Data Center Heat Recovery Design
- Final PV Design
- Energy Model Analysis
- M&V Plan
- M&V Design
- Tenant M&V Plan
- Develop System Manuals
- Create O&M Manual
- Energy Model Analysis
- M&V Data Collection

REWIRE SOLUTION

Through carrying out these deliverables, the As-Built energy model was conceived and compared to the initial As-Design energy model that was developed during the initial design phase of the building. The annual energy consumption of both was found to be:

- As-Built energy use is 22% lower than As-Design model indicated.
- EYP Energy Model Report (Appendix B) identifies heating cost to be significantly higher.
- As-Design Total Building Energy Consumption (kBtu) by End Use was 32,549,898 kBtu with Energy Use Intensity of 97.08 kBtu/ft2/yr.
- As-Built Total Building Energy Consumption (kBtu) by End Use was 31,835,500 kBtu with Energy Use Intensity of 94.95 kBtu/ft2/yr.

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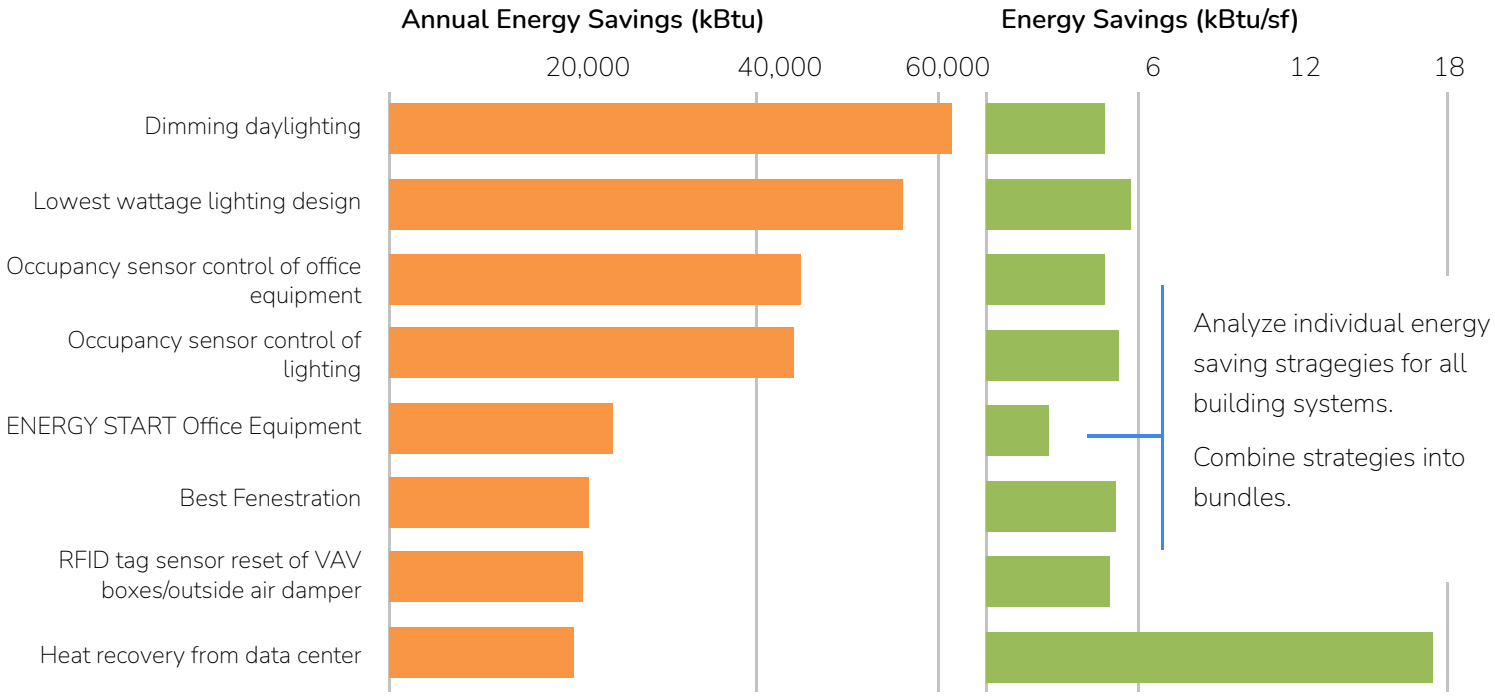

REWIRE RESULTS

The ReWire Team employed a Digital Twin and Data Warehouse to enable the utilization of third party analysis as a critical element in the implementation of a M&V plan, M&V design, and M&V data collection to allow for ongoing M&V management in the future: This M&V infrastructure will soon use FacilityConnex to allow for ZEN engineering staff, NYSERDA and approved third parties the ability to compare energy usage to target values as well as normalize performance data.

Through the measurement and verification process, ReWire was able to not only provide insight on how to improve energy performance, but also provide guidance and direction for SUNY Poly's high performance advanced manufacturing facility or building projects. This is indicated in SUNY Poly's "Key Takeaways" from the project:

- Perform test well tests to determine ground source heat pump viability before initial design steps for future buildings.
- HVAC and System controls need to incorporate industrial process design and specifications as well as control vendor and installation contractors. Send to process vendors instead of traditional commercial building management vendors.
- Evaluate PV location and viability before initial design.
- Massing ended up picking a design (atrium) we did not think would work due increased HVAC energy consumption, but did work when total benefits from reduced lighting consumption were included. ETFE roof system technology reduced first costs to make this option economically viable.
- The Shimizu BMS system was designed for traditional commercial building operation and the ZEN facility required a process control approach commonly used in advanced manufacturing. As a result, a digital twin of the GE-iFix BMS and Schneider Energy Monitoring System (EMS) was created to allow for the application of multiple emerging data analysis platforms that did not exist when the project was built (2015) for use in technology innovation as a living laboratory and for workforce training as a training test-bed.
- Although the BMS and EMS systems selected provide real time monitoring and control of each system, they are operated as separate systems and not optimized as a true integrated system-of-systems. Therefore, the team is developing a standardized process to measure if the building is operating at net zero energy going forward.
- A digital twin of the BMS and EMS has proven to be critically important to enable the use of state-of-the-art continuous commissioning analysis platform (FacilityConnex) that applies over 300 algorithms to energy load data, system performance data, and financial data to identify areas of inefficiency and measure, optimize the overall performance, and ascertain if the ZEN facility achieves net zero operation