Performance and Preservation: Retrofitting a Gothic Church

Stefani Danes
Adjunct Professor of Architecture, Carnegie Mellon University & Chair, Renovation Committee, East Liberty Presbyterian Church

Beth Eckenrode
Principal and Co-Founder, AUROS Group
East Liberty Presbyterian Church, one of Pittsburgh’s most beautiful landmarks, is costly to maintain. With a growing congregation and an active role in the community, the church needed to improve their stewardship of their facilities.
ELPC has undertaken its first comprehensive renovation to increase building utilization, reduce energy costs, and improve indoor air quality.

Passive House principles guided an integrative design process toward aspirational building performance goals.

Technology enabled the team to:
- set performance goals
- remain within budget
- demonstrate that the goals were met
East Liberty Presbyterian Church

- 1930’s Gothic-style construction
- Iconic community landmark
- Growing and active membership
- Host to community events and programs
- Increasing building use

With its “radical hospitality”, ELPC welcomes everyone
Guiding Principles

- Long life/loose fit
- Small interventions
- Spirit of Gothic
- Honoring original design intention
- Sustainability
- Partnerships

Facilities serve the church’s mission
**Team**

- East Liberty Presbyterian Church
- Pfaffmann + Associates, Architects
- CJL Engineering
- AUROS Group

**Process**

- Church’s strategic planning
- 2-year integrated design process
- Energy modeling and mock-ups
- Multidisciplinary energy task force

*Integrated team + model = highest performing building at lowest cost*
Passive first

Active second

Renewables last

Passive House principles provided decision-making hierarchy
A detailed energy model informed goals and choices
Air Leakage: on the leaky side of average (0.5 cfm/sf)*

Leaks:
- Window frames (broken operators, corroded surfaces)
- Doors
- Mechanical shafts, ducts, and penetrations

*ASHRAE 2009
The energy model quantified goals and savings

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
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<tbody>
<tr>
<td>Site EUI – Existing (kBtu/sf/yr)</td>
<td>83.6</td>
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<tr>
<td>Site EUI – Goal (kBtu/sf/yr)</td>
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<tr>
<td>Energy Savings/year ($)</td>
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<td>Energy Savings/20 years ($)</td>
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<td>Existing GHG Emissions (CO2e/yr)</td>
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<td>GHG Savings/year ($)</td>
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<td>GHG Savings/20 years ($)</td>
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</tbody>
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*Total includes HVAC, lighting & plugload savings.

Construction Budget: $6 million (no premium for performance)
Performance goals:

- 25% reduction in site EUI
- Significant improvement in Indoor Air Quality (IAQ)

Digital meters and weather station installed to track water, gas, and electricity usage.

We aimed for the highest performance we could afford
Problem: knowledge of the building handed down over time

Solution: do a thorough exploration and inventory of the building

Benefits: able to take advantage of the building’s existing resources to reduce energy use

Strategy 1: Get to know the building in detail
Problem: historic architecture with 3 foot thick uninsulated stone walls and leaded glass windows

Solution: repair and weatherstrip windows and add exterior glass doors at entrances

Benefits: reduced heating costs; reduced humidity, reduced particulate matter resulted in increased comfort
Strategy 3: Take advantage of naturally comfortable space

Problem: activities in warmest rooms while cooler space was underutilized

Solution: renovate ground floor to accommodate third floor uses

Benefits: increased capacity and occupant comfort
Strategy 4: Restore built-in cooling system

**Problem:** ventilation system for large gathering spaces had been disabled

**Solution:** repair the fans that draw outside air through cool basement space and into those spaces

**Benefits:** no need to invest in new system; refurbished versus replaced
Strategy 5: Replace air conditioners with ventilation

**Problem:** window air conditioners had been added to individual meeting rooms and offices while building lacked required ventilation

**Solution:** install new DOAS system to improve ventilation and reduce humidity

**Benefits:** greater comfort with less energy consumption, more usable space
Strategy 6: Update controls on heating system

Problem: boiler and radiator system had original manual controls

Solution: install an electronic control system

Benefits: ability to respond to changes in outside conditions and program night purges
Problem: Conventional maintenance cannot optimize performance over time

Solution: Digital management tools were developed; smart infrastructure designed to be easy to use

Benefits: Ongoing commissioning for long term performance management; performance gaps immediately visible

Strategy 7: Develop facilities management program
Customized dashboard makes it easy to see how the building is performing compared to the targets.

Divergences are instantly transmitted to facility manager.

Strategy 7: Develop facilities management program
Lessons Learned

- Thorough knowledge of the building is critical to optimizing performance.
- Process demands broader comfort zones
- The latest technologies are not necessarily the most appropriate technologies
- It is possible to achieve significant improvements in energy conservation and air quality in historic buildings