East Liberty Presbyterian Church
THE CATHEDRAL OF HOPE

AUROS GROUP

Performance and Preservation: Retrofitting a Gothic Church

Stefani Danes

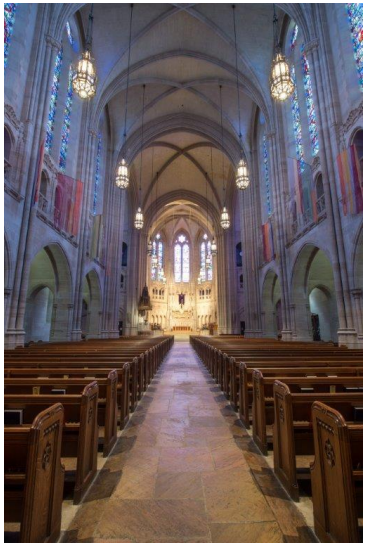
Adjunct Professor of Architecture, Carnegie Mellon University &
Chair, Renovation Committee, East Liberty Presbyterian Church

Beth Eckenrode

Principal and Co-Founder, AUROS Group

EAST LIBERTY PRESBYTERIAN CHURCH

Pittsburgh, Pennsylvania



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

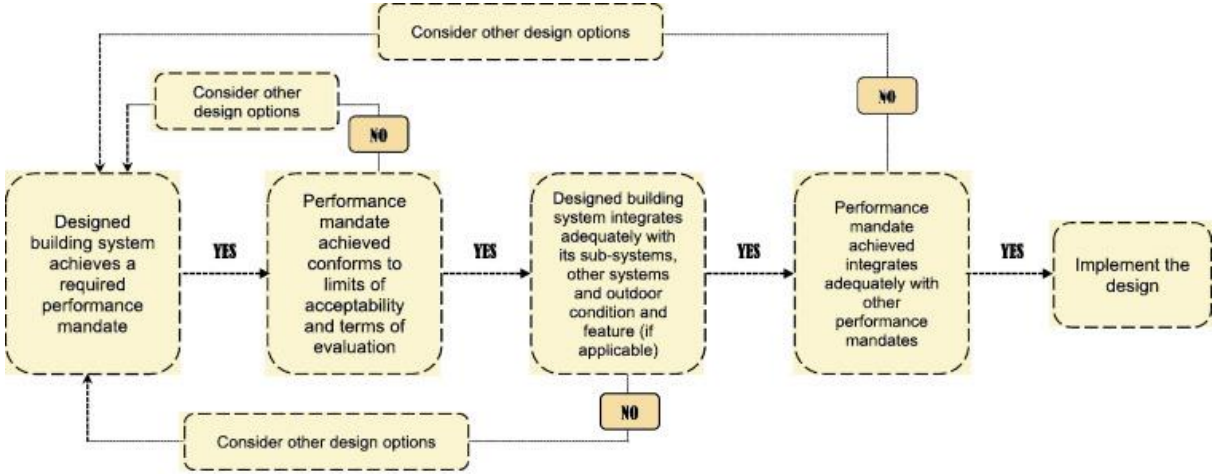
- 1930's Gothic-style construction
- Iconic community landmark
- Growing and active membership
- Host to community events and programs
- Increasing building use

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

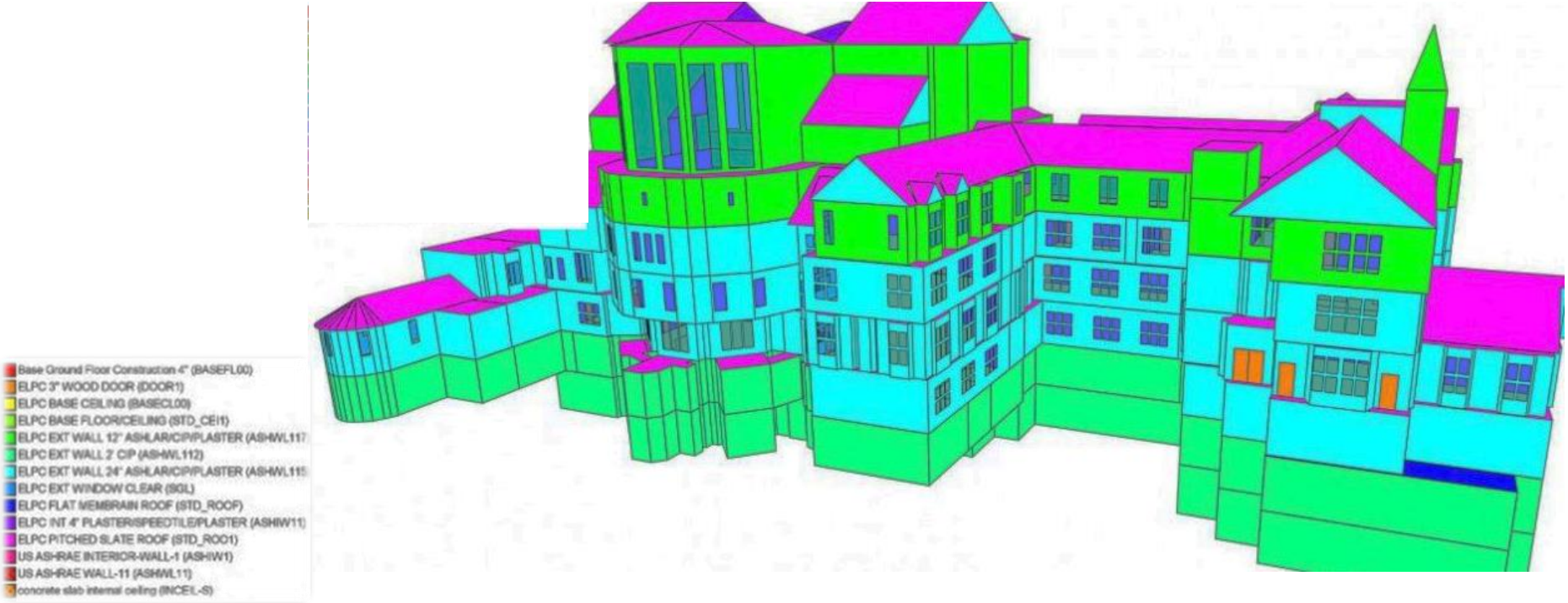
Integrated team + model =
highest performing building at lowest cost

Passive first

Active second

Renewables last

Passive House principles provided decision-making hierarchy

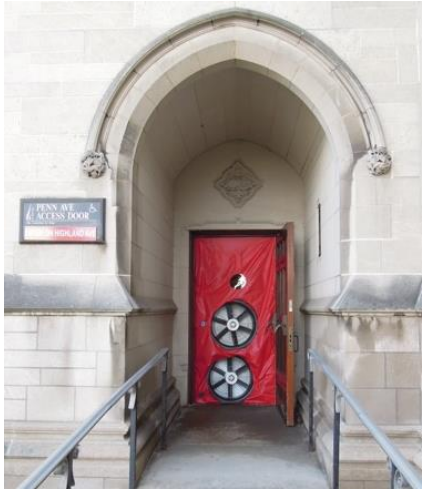


A detailed energy model informed goals and choices

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

Whole-building blower-door testing measured air infiltration

Site EUI – Existing (kBtu/sf/yr)	**83.6**
Site EUI – Goal (kBtu/sf/yr)	**58.6**
Energy Savings/year ($)	$140,000*
Energy Savings/20 years ($)	$2,800,000
Existing GHG Emissions (CO2e/yr)	912.1
GHG Emissions Goal (CO2e/yr)	639.3
GHG Savings/year ($)	$9,800
GHG Savings/20 years ($)	$196,000

*Total includes HVAC, lighting & plugload savings.

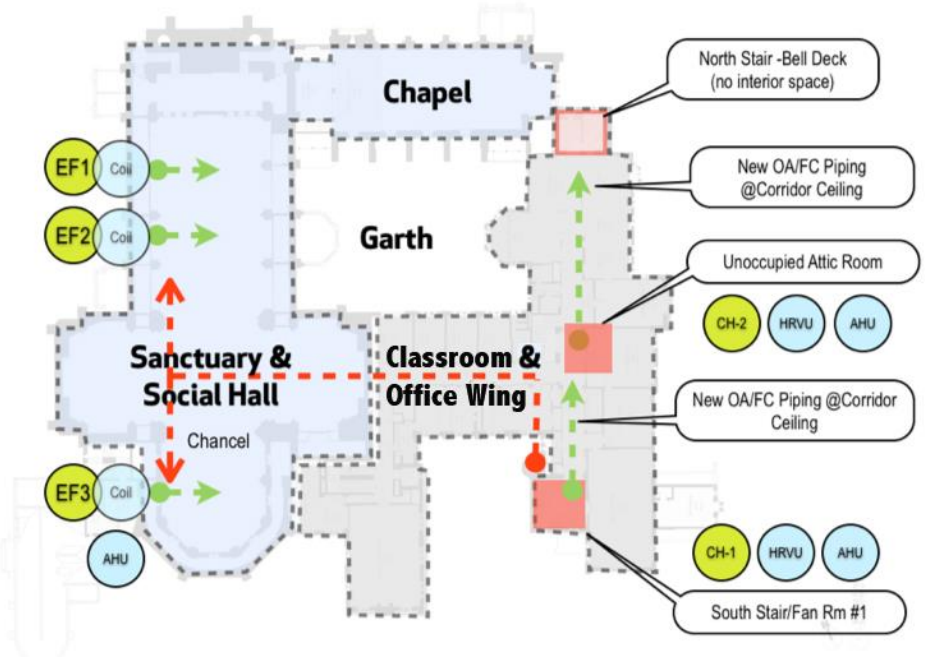
Construction Budget: $6 million
(no premium for performance)

The energy model quantified goals and savings

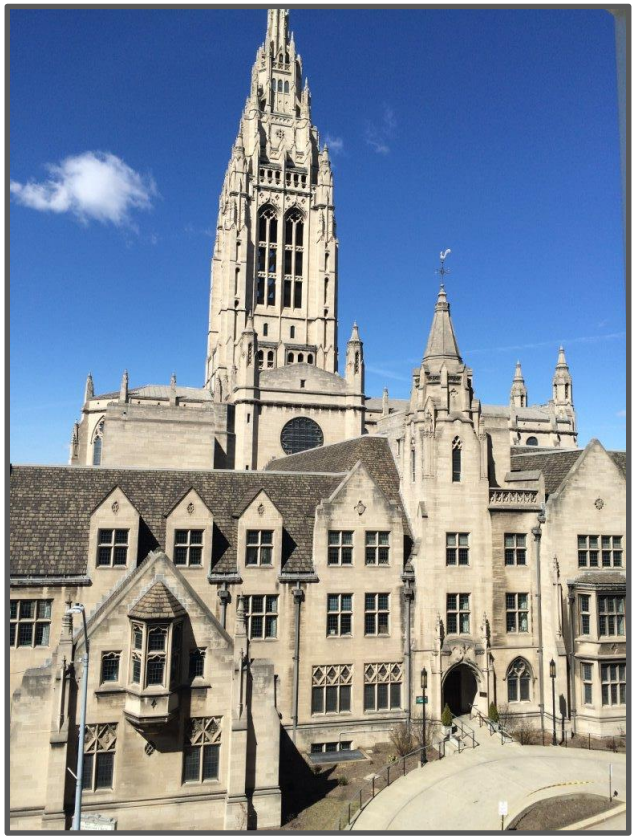
Performance goals:

- 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

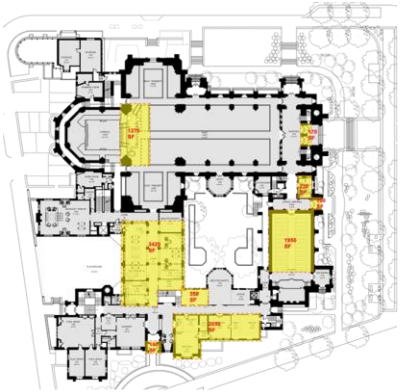
Problem: historic architecture with 3 foot thick uninsulated stone walls and leaded glass windows

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

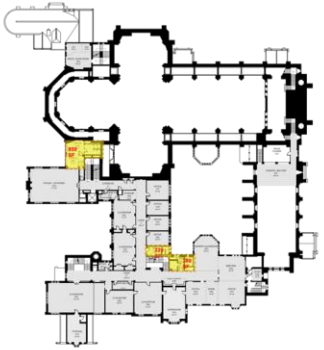
Benefits: reduced heating costs; reduced humidity, reduced particulate matter resulted in increased comfort

Strategy 2: Improve the envelope

Ground



First



Second

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

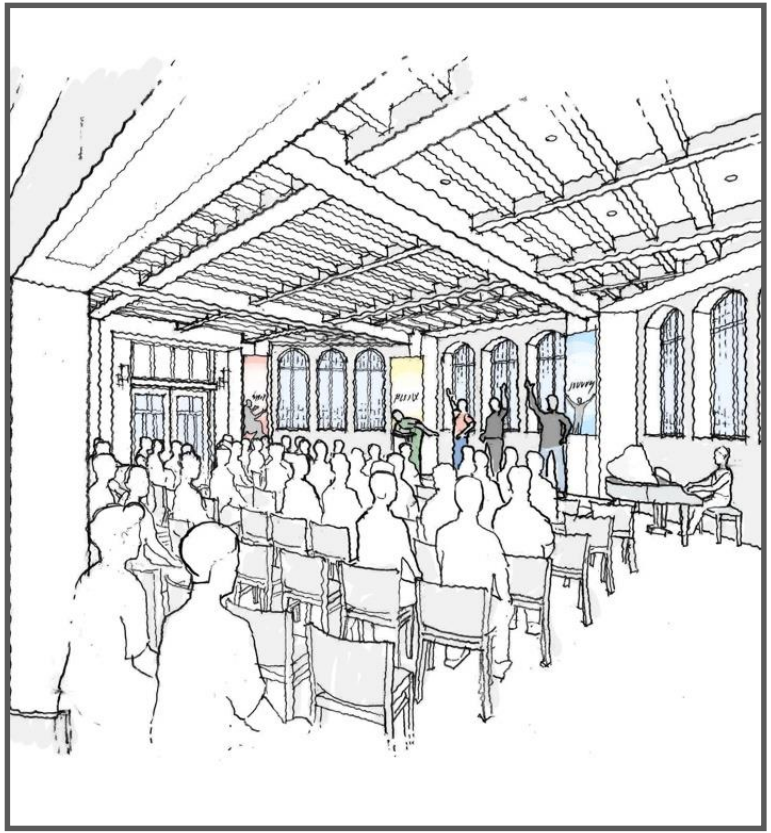
Strategy 3: Take advantage of naturally comfortable space

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 4: Restore built-in cooling system



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

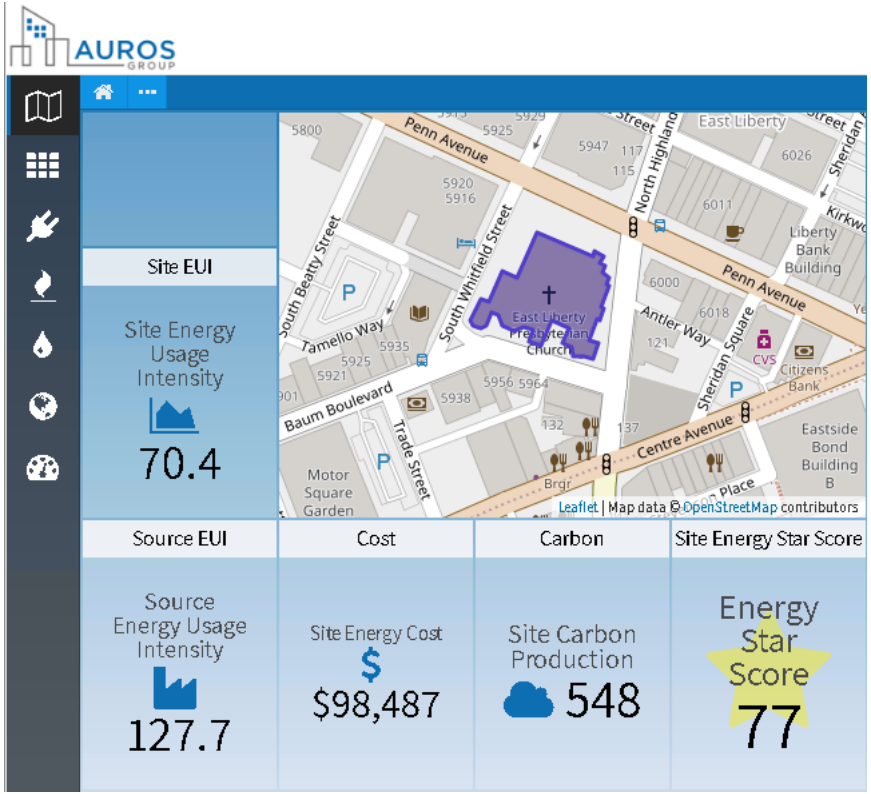
Strategy 5: Replace air conditioners with ventilation

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

Strategy 6: Update controls on heating system



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