# 2015 Annual Conference

Newcomb & Boyd
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## Seminar XX – Energy Efficient Labs: Case Studies

Beyond LEED Platinum – A Case Study for a High Performance Laboratory Building

*Atlanta, Georgia*

# Learning Objectives

- Explain the key design objectives when approaching the design of a new, or the retrofit of an existing, laboratory or vivarium.
- Describe some of the factors that come into play when dealing with CAV to VAV laboratory HVAC systems, and non-standard HVAC systems, and how environmental health and safety plays a role in those decisions.
- Describe the systems that should be used to monitor and manage energy usage and show results, and what should be anticipated when comparing expected versus actual performance.
- Explain how to perform "back of a napkin" calculations for potential energy savings concepts.



# Acknowledgments

- Georgia Institute of Technology
- Cooper Carry
- McCarthy Building Companies
- Heery International

# Outline/Agenda

- Project Background
- Design Criteria Process
- Project Goals
  – Strategies to Achieve Goals
- Performance Measurement
- Conclusions

# Project Background

- Georgia Tech Engineered Biosystems Building (EBB)
  - Part of the Campus "Bioquad"
  - Collaboration between Colleges of Science and Engineering
  - 220,000 SF (20,400 m²), $90,000,000 Construction Budget
  - Project Features Include:
    - Vivarium, Computational Research, Open Lab and Support Space
    - Private offices, Seminar, and Conferencing

# Design Criteria

- Integrated Design Charrette
  - Design Team
  - Construction Team
  - Owner – User Group
  - Owner – Facilities & Operations
  - Owner – CPSM

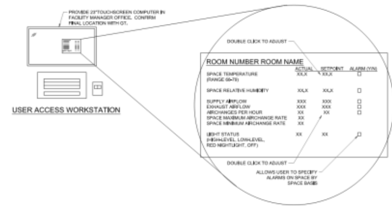
## Project Energy Goals

*"Georgia Tech would like for this project to be the most sustainable building on campus, as their goal is for every new project on their campus to be the most sustainable building they've built."*

- Drive Air Changes Down
- Minimize 100% Outside Air Systems
- All Heat Recovery Considered
- Demand and Occupancy Control
- EUI – 25% better than existing BioQuad

## Drive Air Changes Down

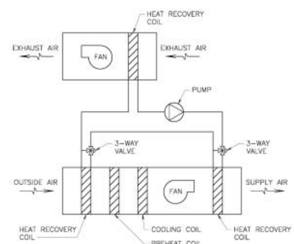
- Laboratory Systems (Board of Regents)
  - 6 Air Changes/Hour (ACH) – Occupied
  - 4 ACH – Unoccupied
- Vivarium Systems (AAALAC Guidelines)
  - 10-15 ACH
  - User Adjustable to Allow Reduced Rates




## Minimize 100% Outside Air

- Separate Systems for Labs/Vivarium and Offices
- Chilled Beams
  - Roughly 375 Beams in the Project
  - Reduced 100% Outside Air Systems by 60% (60,000 cfm/100,000 $m^3$/hr Reduction)
  - Two Stage Control Strategy
  - Not Used Universally

## Heat Recovery




Fume Hood Exhaust:
- Heat Pipes

General Lab Exhaust:
- Enthalpy Wheels

Vivarium Exhaust System:
- Two-Stage Runaround Loop
- "Free" Reheat for high air change spaces
  - Saves 1,100 MMBTU (30,000 kWh)/Year
- Increased Summer Performance
  - Potential for Latent Recovery

## Demand Control

- Occupancy Sensors
  - HVAC Tie-In
- Supply Air Temperature Reset
- Fume Hood Sash Closer
  - $3000/Hood Cost Add
  - 6 month-1 year Payback

## EUI

Improve project EUI by 25%
- Average BioQuad EUI:
  - 415 kBtu/sf/yr (4,700 MW/$m^2$/yr)
- LEED Baseline EUI:
  - 361 kBtu/sf/yr (4,100 MW/$m^2$/yr)
- Designed EUI:
  - 222 kBtu/sf/yr (2,500 MW/$m^2$/yr)
- Energy Use Savings:
  - 38.5% LEED
  - 46.5% BioQuad

## Performance Measurement

Macro Metering:

- HVAC
  - Pumps, Fans, Boilers
- Electrical
  - 14 Meters
  - Lighting (int), Lighting (ext), Process, PV, Elevators
- Water
  - 18 Meters

Micro Metering

- Energy Recovery Performance
- Variable Frequency Drives
- BACnet

## Conclusions

- Early Team Involvement Critical
- Look for Opportunities to Challenge Traditional Design
- Performance Measurement for Troubleshooting

## Questions?

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