# Achieving Energy Efficiency in Existing Buildings

**Development of Software System Prototype for Optimized Commissioning of Building HVAC**

**M. Gevelber & D. Wroblewski**
**Mechanical Engineering, Boston University**

- How achieve significant commercial building energy efficiency?
  ⇒ Focus on HVAC.

- Our solution: System that re-optimizes existing HVAC system airflow.

- Provides unique software based solution for hidden problem with high-payback.

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# Background/Overview

- Existing commercial buildings offer significant energy savings opportunity
  36% of US electricity
- HVAC ~ 50-70% of building energy use, but use is hidden.
  20-35% of electricity used to push air!
- Key: reduce air flow.
- **Our solution: Re-optimize building HVAC system based on software approach**.
  Works with existing Building Automation System (BAS)
- Unique: Solves problem not addressed by current tools.
  No previous patent.
- Nega-watt: cheapest energy "source" by 4-10x

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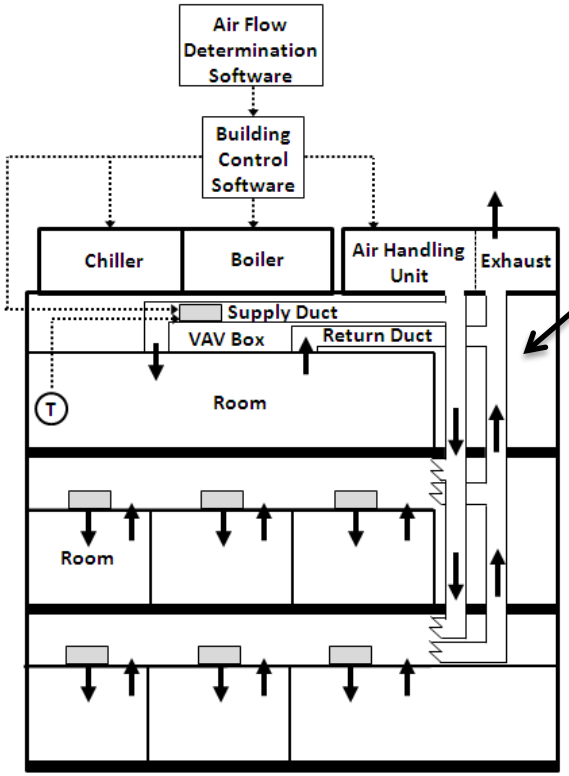
# Basis for Opportunity/Value & Core Concept

- Many buildings designed when energy was cheap so used high air flow to assure ventilation, humidity, and thermal needs were met.
- For existing buildings, hard to know "how low you can go"
- Should base design on minimum air flow for ventilation & lab safety
- Our system provides easy basis to re-optimize




**Building HVAC Schematic**

Room-by-room experiments run through existing BAS
Software based: No labor needed

Determine actual ACH for each room (No plans needed)

Establish minimum ventilation needs

Reset ACH through existing BAS software

Aggregation enables building-level optimization

Enables monitoring/ diagnostics & commissioning

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# Team

**Michael Gevelber**
**BS Physics Brown Univ.**
**MS, PhD Mech. Engr. MIT**

- Advanced sensors and control for electrospinning of nanofibers, plasma spray for TBC, crystal growth
- Energy Consulting & DOE experience
- Led BU Energy Audit over past 4 years
- University Sustainability Committee & Co-Chair, BU Energy Working Group

**Donald Wroblewski**
**BS Mech. Engr. Penn State**
**MS, PhD Mech. Engr. Cal, Berkeley**

- Broad Thermal-fluids expertise
- 8 years experience HVAC & Energy Building Experience-- Carrier Research
- Experiments and sensor development for Plasma Spray, Turbulent Transport
- Professional Engineer

**Paul Gallagher**
**MEng Aero. Engr. Bristol, UK**
**Graduate Student, BU**

- 8 months experience on project
- Data acquisition
- Building modeling
- Algorithm refinement
- Continuum BMS experience

## Industry Collaborators: reality check

**Domenic Armano, Johnson Controls**, the leading supplier of Building Automation Systems

**Paul Kondrat** Director of HVAC Engineering at **TRO Jung|Brannen**, an Architecture/Engineering firm

Andy Rubin, Director of Business Development at **AMERESCO**

## BU Facilities

**Tom Daley**, Associate VP

**Bill Walter**, Assistant VP

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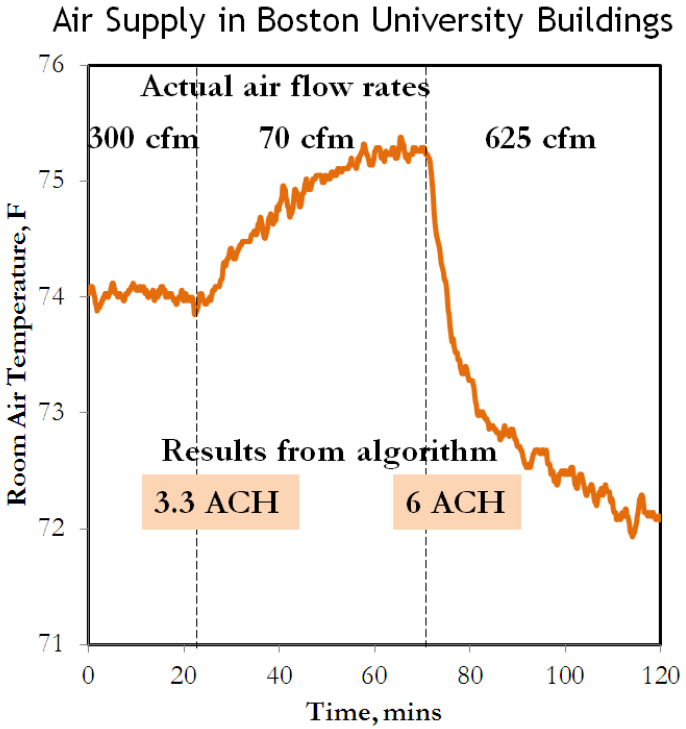
# Preliminary Results: Single Room Test




- We based our approach on extensive study of 8 real buildings
- Addresses “hidden” energy use that can’t be found by trending
- Based on real data from room-by-room controlled experiments, which achieves a robust solution.

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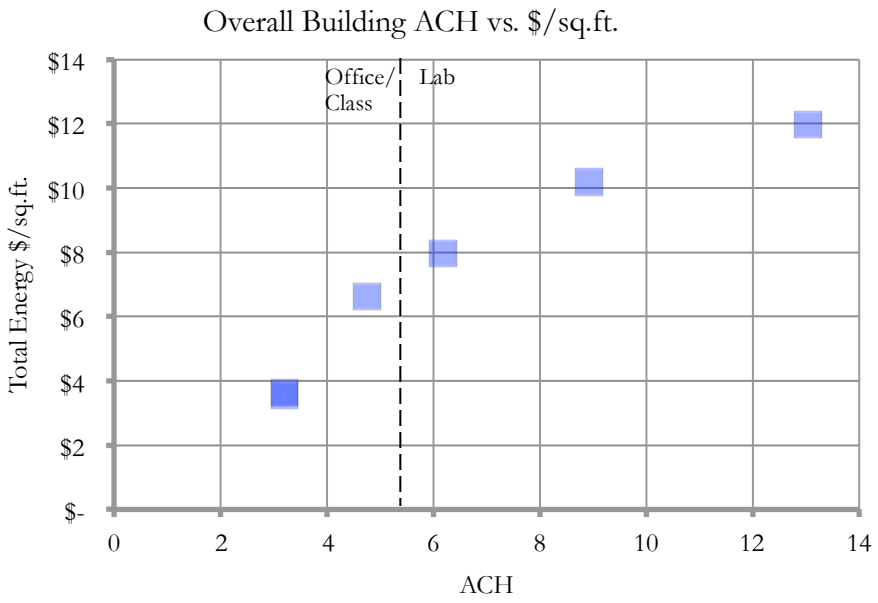


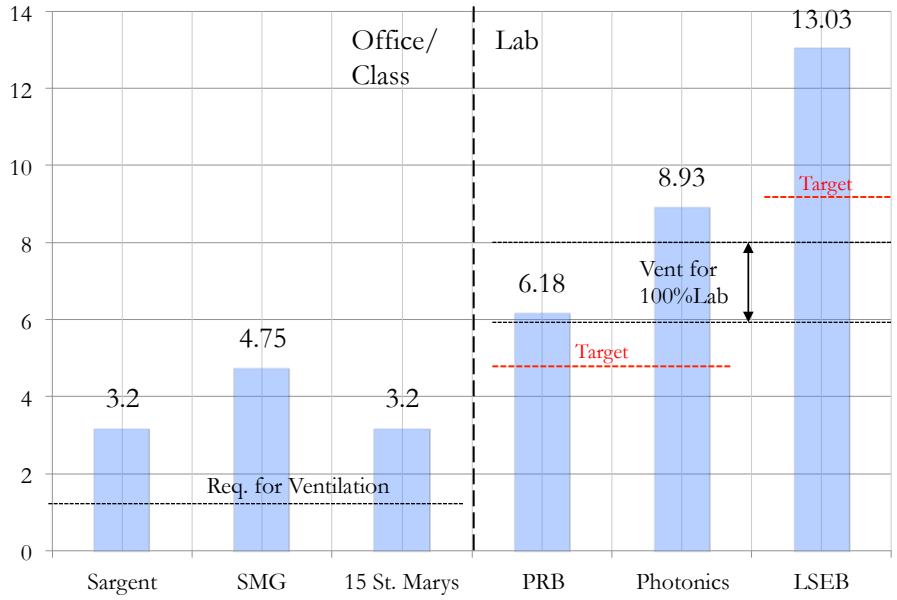


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