enVerid Systems Inc. - Commercial Building Technology Demonstration

2016 Building Technologies Office Peer Review

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Project Summary

Timeline:

Start date: Oct, 1st 2014

Planned end date: Sep, 30th 2017

Key Milestones

1. At least one successful installation already in operation, Sep 30th 2015.
2. One vendor (or more) qualified to manufacture HLR modules in USA, Sep 30th 2015.

Budget:

Total DOE $ to date: $614 K

Total future DOE $: $1,786 K

Target Market/Audience:

Commercial real estate and public building owners/managers, HVAC engineering consultants, electric utilities

Key Partners:

Johnson Controls	
Mars Mineral	
NREL	
NETL	

Project Goal:

The objective of this project is to install and operate modular HVAC Load Reduction (HLR) retrofits in multiple and diverse buildings, monitor their performance, analyze the energy savings, overall economics, and verify Indoor Environment Quality/Indoor Air Quality IEQ/IAQ with specific tests for CO2 and other contaminants of concern (to be determined prior to demonstration initiation). The set of buildings selected for demonstration will collectively represent target markets based on market and commercialization analyses and strategies. The demonstrations will result in the creation of a body of validating case studies and data to encourage and enable widespread adoption around the country.

Background

Problem Statement: Air replacement is a standard practice in commercial HVAC, necessary to remove indoor generated molecular contaminants and maintain indoor air quality. A significant fraction of the total cooling or heating load of typical HVAC systems is due to air replacement. The project objective is to provide the quantitative evidence and practical experience to enable HVAC load reduction and energy savings by scrubbing indoor air as an alternative to air replacement.

Target Market and Audience: The target market is air conditioned commercial and public buildings – office, retail, schools, and other public venues, of which there is over 90 billion sqft. The primary audience is

- The decision makers: owners, operators and facility managers
- Influencers: distributors, contractors, regulators, utility companies, sustainability executives, energy service companies, and the engineering community.

Demonstration Objectives

1. Verify that the air cleaning technology:
   - Will reduce energy costs relative to baseline operation without the technology (annual, monthly)
   - Maintain or improve indoor environmental quality and meets ASHRAE Standards 62.1 and 55
2. Assess the deployment potential for other sites and identify screening criteria for future candidate buildings
3. Identify technical and practical challenges that emerge in design, installation, control, and operation
4. Document occupant and staff satisfaction
5. Estimate the economic performance of the technology

Monitoring and Verification Approaches

- Energy performance (alternate weekly operations)
  - Baseline with HLR systems off
  - HLR on
- Maintaining IEQ
  - Follow ASHRAE 62.1 Indoor Air Quality Procedure (IAQP) – worked with a team of subject matter experts
  - Pre-installation characterization of the spaces for CO_2, VOCs, and other contaminates – establish the contaminants of concern
  - Continuous monitoring of CO_2 and TVOC (as a check)
  - Spot measurements for contaminants of concern
  - Occupant surveys – 80% satisfaction

First Demo Project: U. of Miami Wellness Center

- 2 stories of a 13 story building
- Effective Area = 45,000 ft^2

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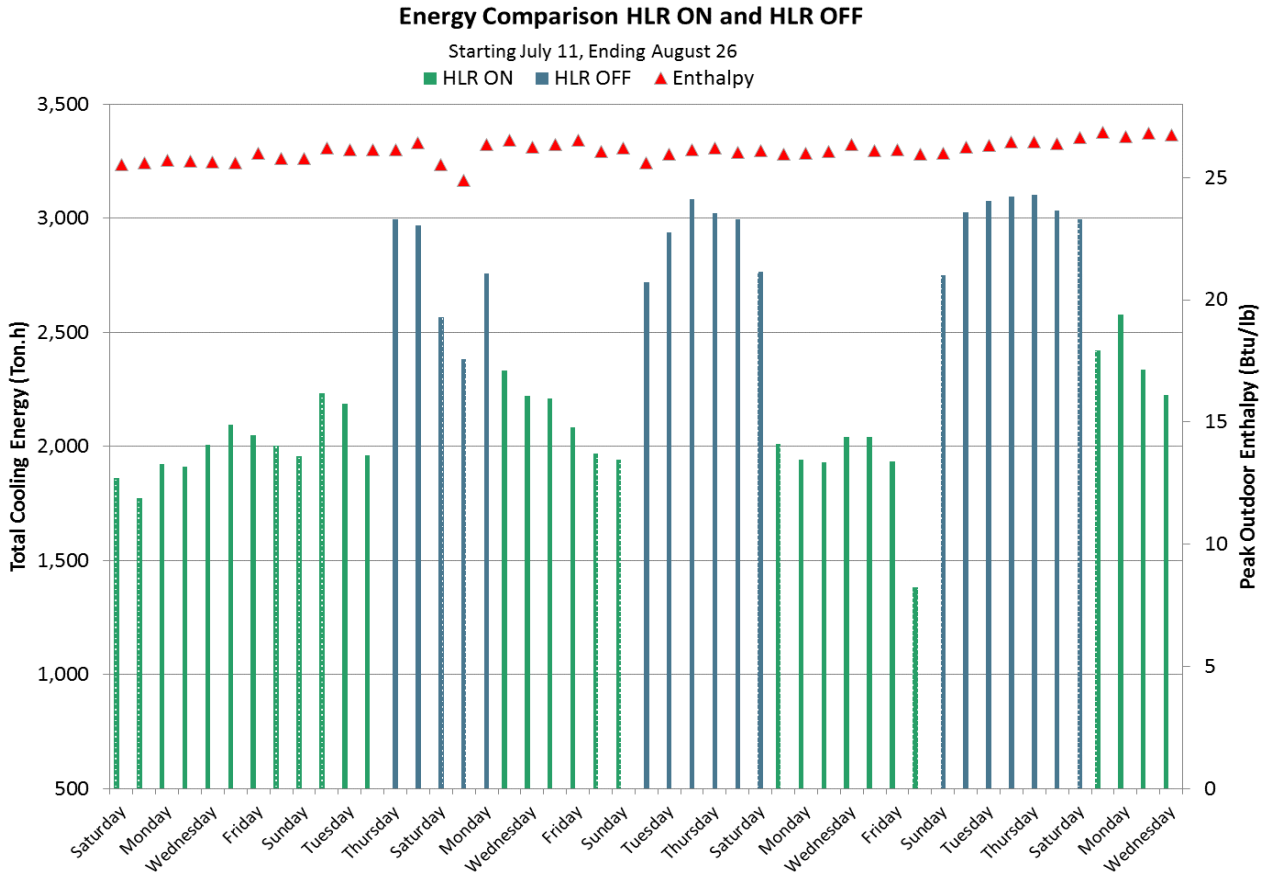
Average Measured Energy Savings: 29%



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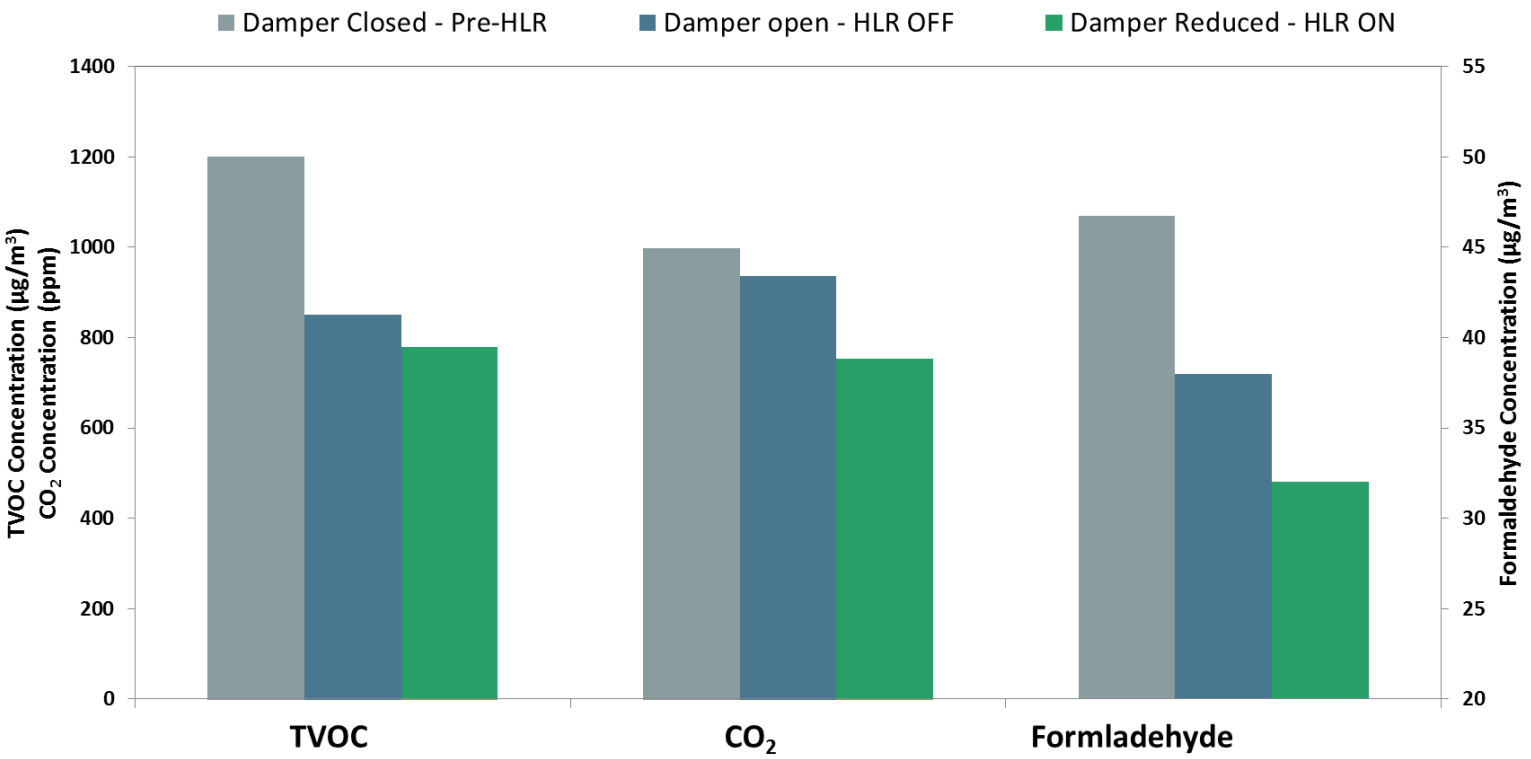
Air Quality Impact of Ventilation and of HLR



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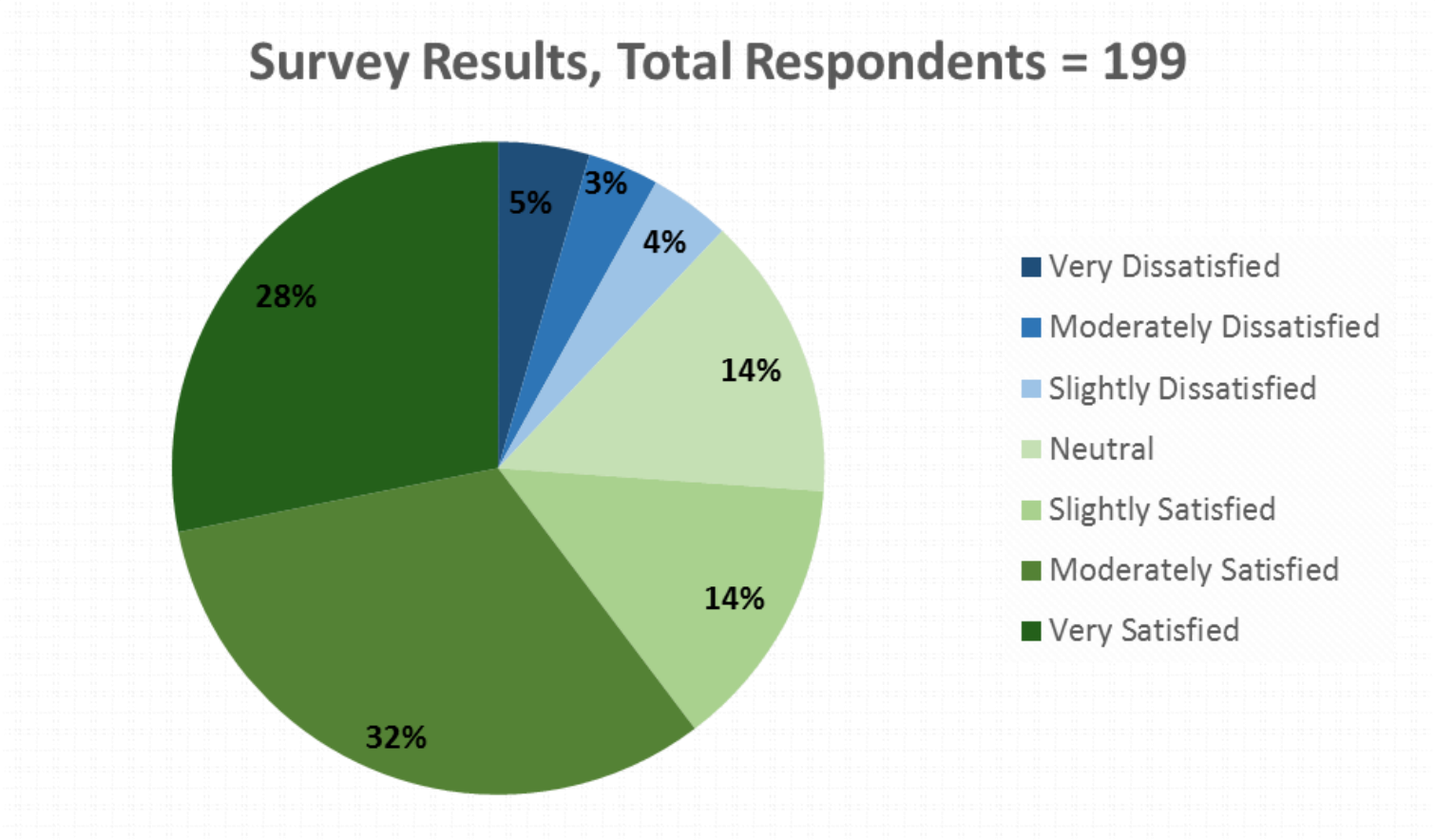
Sample Air Quality Survey Results*



* These results are from a different demo, for illustration

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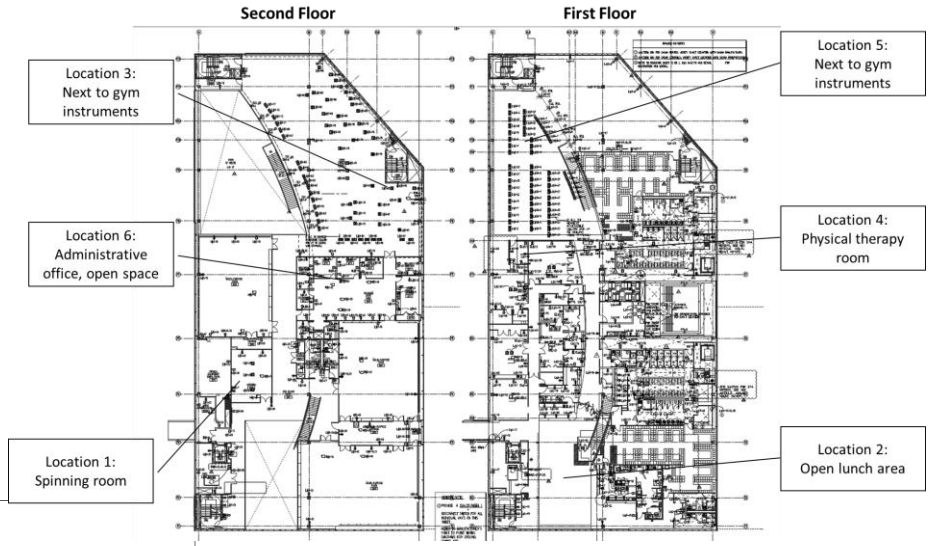
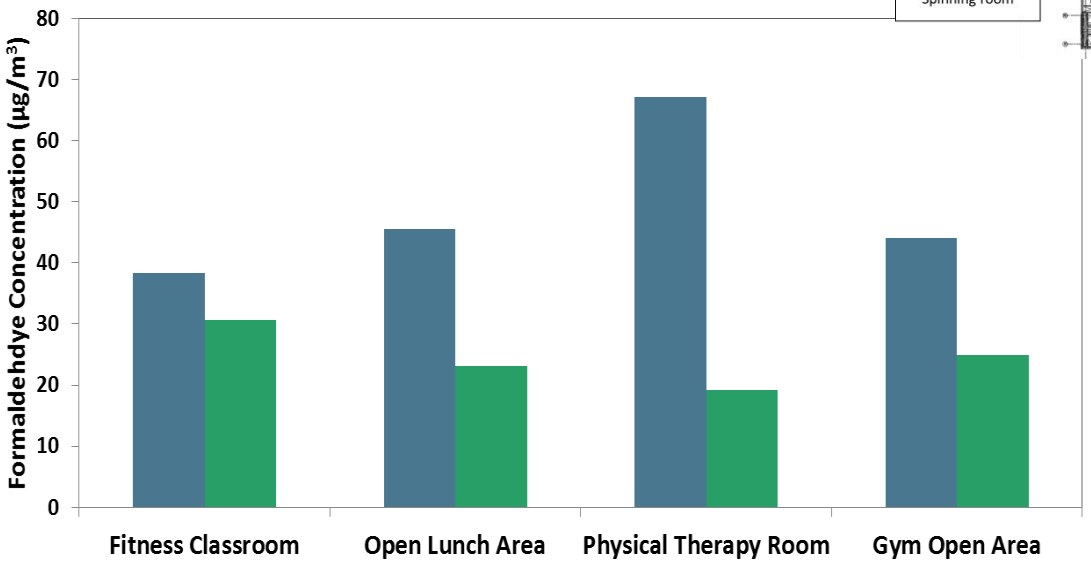
Location-specific Formaldehyde Testing





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Progress and Accomplishments

I. First working installation commissioned at University of Miami wellness center in Summer 2015. Initial results from late-summer very encouraging.

II. Several additional sites lines up for installation, including:

Building	Location	Floor space
Arkansas Best Corp.	Fort Smith, AK	190,000 sqft
Diplomat Hotel	Miami, FL	200,000 sqft
HSBC	New York, NY	30,000 sqft (2 Floors)

Additional sites being lined up, in various geographies and climate zones.

New, lighter and less expensive unit design developed and produced; will be used in all future installations.

Project Integration and Collaboration

Project Integration: We are in discussion with engineering firms, real estate firms, utilities (ConEd, National Grid, Florida Power, others)

Partners, Subcontractors, and Collaborators: Strong collaboration with Johnson Controls on market introduction and technology.

Communications: AHR, ASHRAE, USGBC; also presented in China, Singapore and India.

Next Steps and Future Plans

Next Steps and Future Plans: Our main activities and to lock down the sites, preform the installation and operate the sites while collecting extensive data, pictures, reports.
Much effort continues to be invested in lighter and more efficient sorbents, simpler module design with better electronics and controls. We also believe that the second wave of sites can be in colder climates where winter/heating energy savings can be measured.

BACKUP / REFERENCE SLIDES

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Project Budget

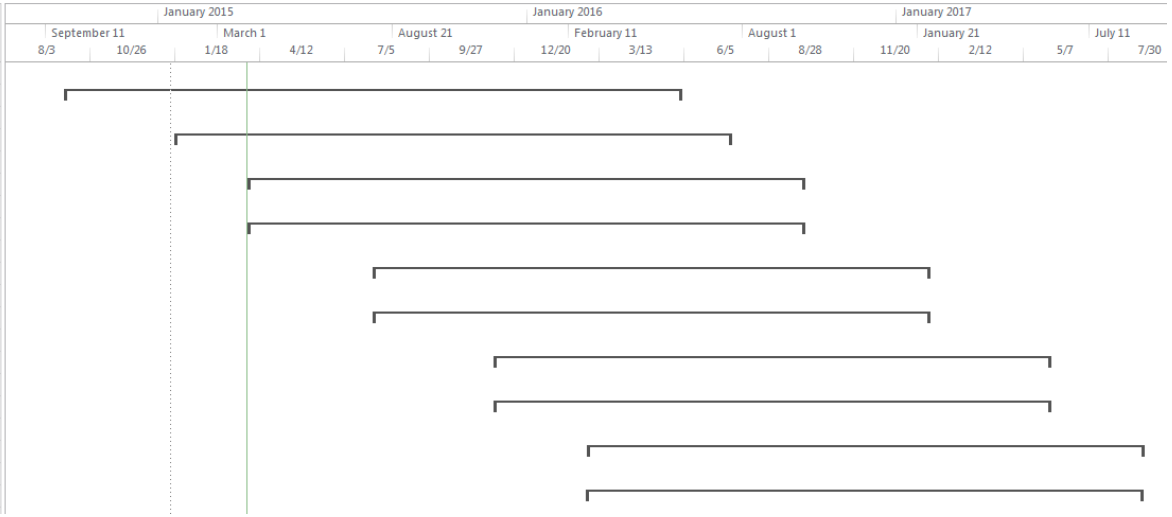
Project Budget: We are behind our schedule and budget, however we are now operating at a run rate consistent with the plan.
Variances: Rate of site recruitment is behind schedule ("late start") but moving forward now at a good speed.
Cost to Date: 25% of project budget
Additional Funding: Not required or anticipated at this stage.

Budget History					
Oct, 1st 2014 – FY2014 (past)		FY2015 (current)		FY2016 YTD (current)	
DOE	Cost-share	DOE	Cost-share	DOE	Cost-share
$0	$0	$521	$521	$93	$93

Project Plan and Schedule

We have successfully achieved all the Go / No-Go goals as planned, including the Marketing plan, at least one site with successful installation, 3 sites or more that have been secured, and 3 sites or more that have been qualified. One vendor (or more) qualified to manufacture HLR modules in USA, and on-site sensors show CO2 maintained below 1100 ppm and other contaminants (VOCs) maintained below levels recommended by ASHRAE, NIOSH or USGBC.

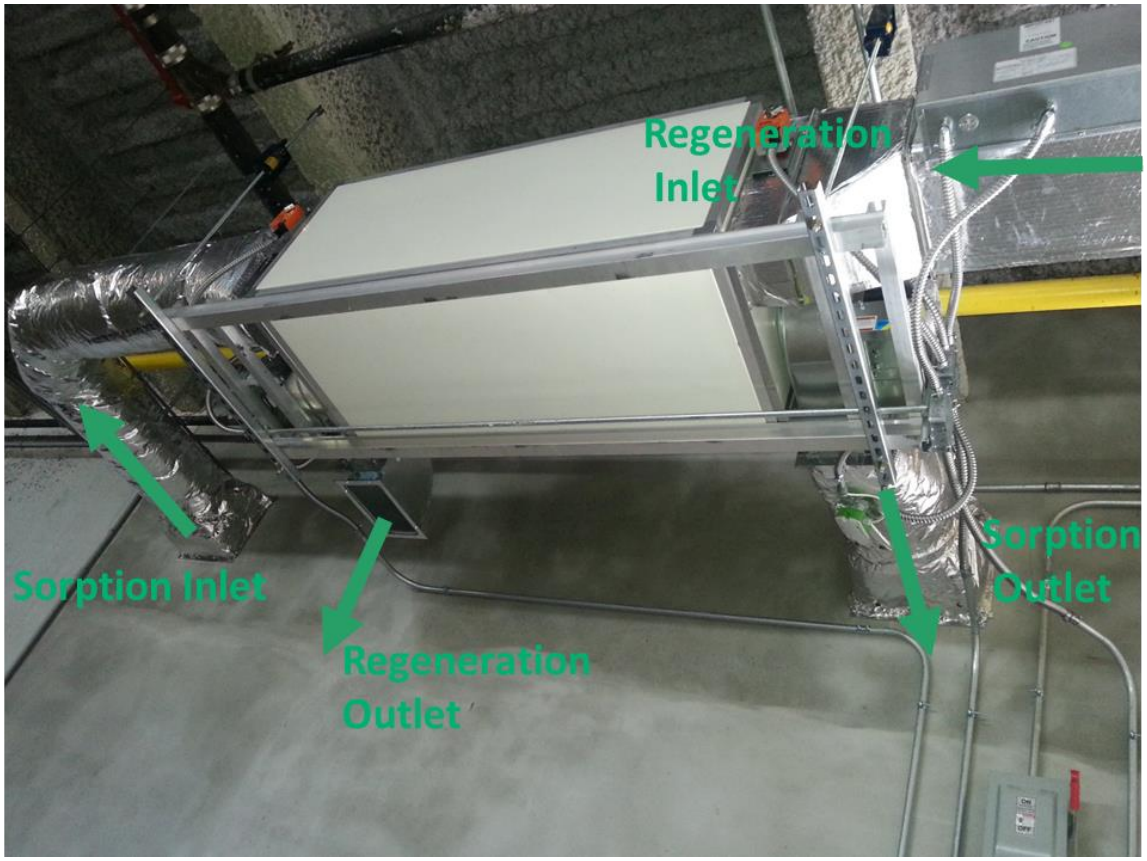
Task Name	Duration	Start	Finish	Predecessors
Site #1 - Installation and Operation/Base lining	435 days	Wed 10/1/14	Tue 5/31/16	
Site #2 - Installation and Operation/Base lining	393 days	Mon 1/19/15	Wed 7/20/16	
Site #3 - Installation and Operation/Base lining	393 days	Wed 4/1/15	Fri 9/30/16	
Site #4 - Installation and Operation/Base lining	393 days	Wed 4/1/15	Fri 9/30/16	
Site #5 - Installation and Operation/Base lining	393 days	Mon 8/3/15	Wed 2/1/17	
Site #6 - Installation and Operation/Base lining	393 days	Mon 8/3/15	Wed 2/1/17	
Site #7 - Installation and Operation/Base lining	393 days	Tue 12/1/15	Thu 6/1/17	
Site #8 - Installation and Operation/Base lining	393 days	Tue 12/1/15	Thu 6/1/17	
Site #9 - Installation and Operation/Base lining	393 days	Wed 3/2/16	Fri 9/1/17	
Site #10 - Installation and Operation/Base lining	393 days	Tue 3/1/16	Thu 8/31/17	



Monitoring and Verification

- Energy
  - HLR energy
  - Chiller
  - Electric reheat
  - Boiler (for cold climates)
  - Total HVAC
  - Heating and Hot Water
- Indoor Environmental Quality
  - Space T&RH & CO_2
  - Return air CO_2
  - Outdoor air T&RH & CO_2
- Occupant Satisfaction
  - Occupant surveys

First Demo Project: U. of Miami Wellness Center



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Project Impact

Impact of Project: The ultimate goal of the project is to overcome market hesitancy that stands in the way of widespread adoption, by creating a critical mass of success stories across different regions and building types. This will be facilitated by accruing enough case studies, success stories and demonstrations, to overcome lingering hesitation and promote widespread acceptance.

The achievement of our goals will be measured by the number of buildings that adopt our technology, both as retrofit to existing systems and ultimately as a part of new designs.

- Near Term: Hundred of retrofit installations
- Mid Term: Thousands of retrofits and some new building designs
- Long Term: Tens of thousands of retrofits and more than 10% of new buildings