



## Seminar 42 The Rise of Building EQ: Educational Facility Case Studies in Central Florida

### Giant Leaps: Building EQ's Application at the University of Central Florida

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**ORLANDO**  
2020 WINTER CONFERENCE  
AND AHR EXPO

## The University of Central Florida

**\$32 million per year in utilities  
793 million kBtu per year**

With more than 68,000 students, UCF is the biggest university in Florida, and one of the biggest in the nation. But being big goes beyond our size. Big is diverse and inclusive. Big is promising and powerful. Big attracts the brightest minds and boldest opportunities. So go on, Knights — dream big. Because big is just the beginning.

**1,440 Acre Main Campus  
180 Buildings**

### Learning Objectives

- **Learning Objectives:**
- Provide an overview of how the Building EQ Portal is utilized on facility projects.
- Understand the application of the Building EQ assessment process in education facility and campus settings.
- Communicate the value of utilizing the Building EQ program for improving the energy performance of educational facilities.
- Identify the value of Building EQ as a training tool for ASHRAE credentialed or licensed engineers to teach students how to conduct energy audits, including young professionals as mentors to engineering students.

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### Energy Plans & Policies

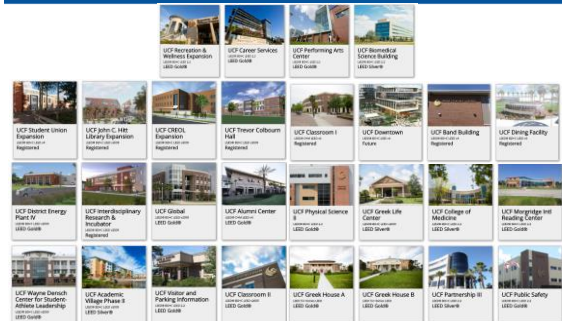
- Collective Impact Strategic Plan
- Campus Master Plan
- Climate Action Plan
  - American College and University President's Climate Commitment
- Energy & Sustainability Policy

### Agenda

- University Background
- Campus Benchmark Plan
- Tools for Achieving the Plan
  - ASHRAE Building EQ
    - RCx
    - Level 2 Energy Audits
    - Modernization Projects

### High Performance Buildings

26 and counting



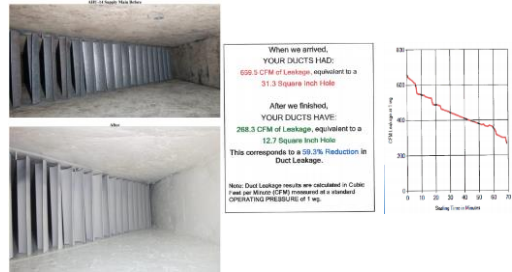


## Re-Commissioning

- Key to lowering OPEX
  - BAS response team hours in FY 17-18 was **66%** due to hot / cold calls
- RCx can get in front of:
  - Maintenance burdens
  - Reducing deferred maintenance backlog
  - Information transfer to Operations
- Guideline 0.2 spells out the process

## Re-T&B is **CRITICAL**...

- Re-TAB identified significant duct leakage
  - One building was leaking **19,475** out of 126,250 CFM Supply

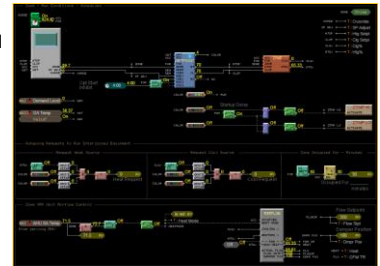


## BAS Point to Point

Utilities and Energy Services UNIVERSITY OF CALIFORNIA, BERKELEY				Re-CX Issues Log Bldg. 0003 Main Chiller Plant			
Issue Reference	Date	Priority	Action / Assignment	Comments / Observation	Action By	Corrective Action	Status
1	1/2/2019	CR-3	CR-3	Section 17 was changed. Unable to verify 11 feed across pump. Feed points are isolated correctly. Factory supplied points should be used. Strip GPM total verified to be correct.	Chris Dine	Review with BAS	Open
2	1/2/2019	CR-3	CR-3	Feed points are isolated correctly. Factory installed points should be used. Strip GPM total verified to be correct.	Chris Dine	Review with BAS	Open
3	1/2/2019	CR-3	CR-3	Condenser return line Ocean Flow Meter installed. No alarm on BAS. Further investigation required.	Chris Dine	Need to review with Nuclea	Open
4	1/2/2019	CR-3	CR-3	Strip and GPM out of line. No alarm on BAS. Further investigation required.	Chris Dine	Need to review with Nuclea	Open
5	1/2/2019	CR-3	CR-3	BTU meter appears to be out of calibration. Measured GPM 2015. BTU meter 3554 GPM.	Chris Dine	Need to review with Nuclea	Open
6	1/2/2019	CR-3	CR-3	BTU meter appears to be out of calibration. Measured GPM 2015. BTU meter 3554 GPM. 2.4 degree difference between measured and BTU meter. Measured 44.3 Btu/h and BTU Meter 41.0.	Chris Dine	Need to review with Nuclea	Open
7	1/2/2019	CR-3	CR-3	Measured condenser water GPM 6772 @ 6.67 FT Bldg. reading 5.77 FT @ 5.77 GPM.	Chris Dine	Need to review with Nuclea	Open
8	1/2/2019	CR-3	CR-3	No project test point for testing do access order Code items.	Chris Dine	Need to review with Nuclea	Open

## Functional Testing

- Sequences of Operations tested
- Sequence enhancements programmed and tested
- Systems Manual updated (and into CMMS and GUI)



## TAB

- Re-TAB
  - Calibrates the BAS
- Returns HVAC to design parameters & records performance degradation
- Restores BTUs, CFMs and GPMs
- BAS now provides trustworthy telemetry

PUMP TEST REPORT				
Job Name: Retro Cx - LES 0003 Main Chiller Plant				DATE:
PUMP DATA				
Pump Designation	SCHWIMM-1	SCHWIMM-2	SCHWIMM-3	SCHWIMM-4
Pump Manufacturer	12012417 / 431C2	12012417 / 431C2	12012417 / 431C2	12012417 / 431C2
Model Number	431C2	431C2	431C2	431C2
Impeller Size	1800	1800	1800	1800 / 2162
RPM	1800	1800	1800	1800
Design GPM	5300	5300	5300	5300
Design Head	180	180	180	180
System FID Pressure				
MOTOR DATA				
Motor Manufacturer	300	300	300	300
HP	1788	1788	1788	1788
Voltage	460	460	460	460
Phase	3	3	3	3
Amperage	332.0	335.0	346.0	346.0
Rated				
Corrected for Voltage				
TEST RESULTS - FINAL				
Section	42.1	Punch	43.7	41.0
Discharge	76.2		81.2	80.4
Pressure Differential	37.1	WALLUET	37.5	38.4
Head in Feet	85.7		86.6	85.0
Final GPM	7681		7644	7454
Test Voltage	NA	NA	NA	NA
Rated	NA	NA	NA	NA
Running Amperage	312.1		282.2	332.0
VFD				

## Monitoring-Based Cx

- Map ReCx project BAS points into Monitoring-Based Cx FDD
- "Human" intervention of FDD faults initially
- If Confidence is > 95%, then FDD faults result in actual work orders



## Modernization Projects

- Perform ASHRAE Level II Energy Audits
  - BAS Contractor, O&M team, EOR & CxA involvement
  - Auditor EOR retained for design
  - Goal is 3 to 6 per year
  - Required to comply with Standard 211
  - Template deliverable defined for auditors to follow

*BAS-centric audits* → *RCx Investigation* = blurred lines

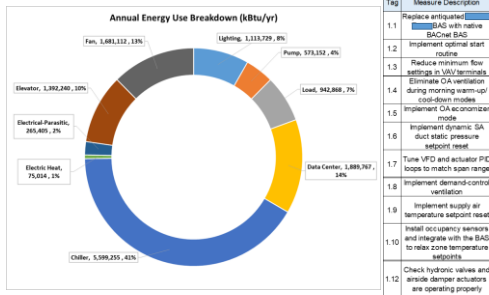
## Conclusion

### By The Numbers

Avoided **\$30.5 million** in utility expenditures  
**26 buildings** are certified under LEED  
**\$25.4 million** in infrastructure improvements since 2014  
 Reduced campus Energy Use Intensity by **42.4%** since 2007

## Modernization Projects

- Energy Scores and Consumption



## Questions?

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## Modernization Projects

- Design documents result in:
  - BAS, Cx & TAB proposals - direct to owner
  - HVAC major equipment - Owner Direct Purchase
  - Continuing services mechanical, electrical, etc. bids.
- Project focus:
  - Control diagrams
  - Sequences
  - BAS GUI
  - Trends
  - Alarms
  - Data for FDD

