AABC Commissioning Group

AIA Provider Number 50111116

Converting CAV to VAV in Florida: What does this really mean?

Course Number: CXENERGY1707

Steve Harrell, CxA, CEM, SSRCx

April 26, 2017

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Course Description

This presentation defines the steps necessary to truly convert all non-sensitive zones in a hospital facility from constant air volume control to variable air volume control and the procedures necessary to comply with AHCA requirements and receive Agency approval in the state of Florida. A case study will be presented highlighting St. Joseph's Hospital North where this conversion has occurred and been approved by AHCA. Energy benefits and complete results will be discussed in detail.

Learning Objectives

At the end of the this course, participants will be able to:

1. Learn how the AHCA approves variable air volume control in Hospitals in non-sensitive zones.

2. Learn how air changes per hour does not equal variable air volume control.

3. Understand the significance of the energy impact of true variable air volume control.

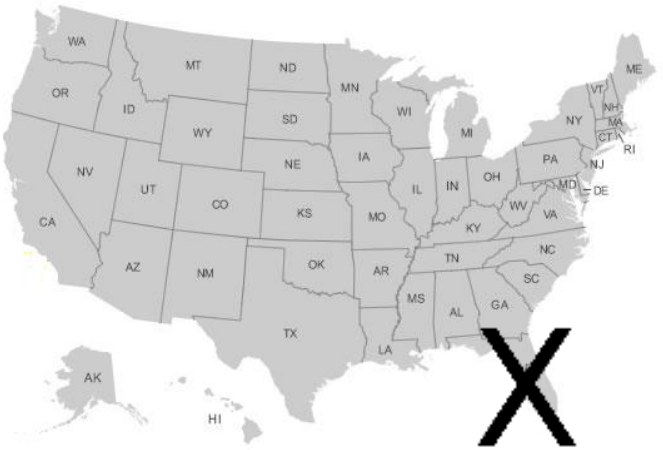
4. Learn about energy management best practices for existing hospitals.

CRITICAL SPACES

- ASHRAE Std 170-2013, 7.1 allows ACH to be reduced during unoccupied times in CRITICAL SPACES

NON CRITICAL SPACES

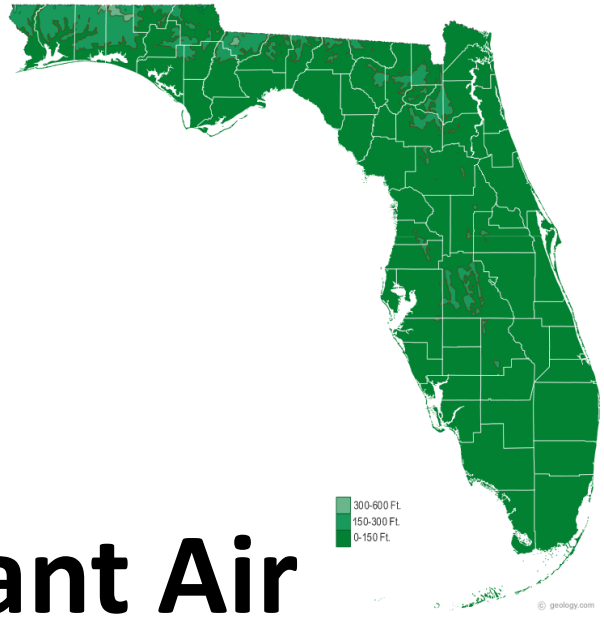
- ASHRAE Std 170-2013, 7.1 allows VAV systems as long as pressure relationships and minimum ACH are maintained in NON-CRITICAL SPACES during ALL times.



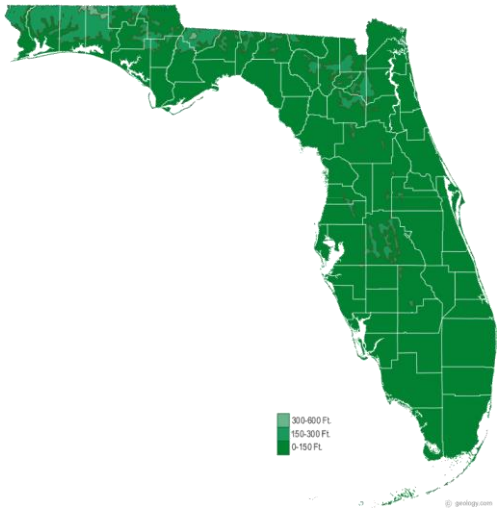
March, 2012

Prior to March 15, 2012

2006 AIA/FGI Guidelines



AHCA required Constant Air Volume only!



After March 15, 2012

FGI Guidelines were adopted with the 2010 Florida Building Code

AHCA now approves Variable Air Volume

17 Zones/Space Types Now Eligible for VAV

TABLE 7-1 Design Parameters

Function of Space	Pressure Relationship to Adjacent Areas (n)	Minimum Outdoor ach	Minimum Total ach	All Room Air Exhausted Directly to Outdoors (j)	Air Rec by M Room
SURGERY AND CRITICAL CARE					
Classes B and C operating rooms, (m), (n), (o)	Positive	4	20	N/R	
Operating/surgical cystoscopic rooms, (m), (n) (o)	Positive	4	20	N/R	
Delivery room (Caesarean) (m), (n), (o)	Positive	4	20	N/R	
Substerile service area	N/R	2	6	N/R	
Recovery room	N/R	2	6	N/R	
Critical and intensive care	Positive	2	6	N/R	
Wound intensive care (burn unit)	Positive	2	6	N/R	
Newborn intensive care	Positive	2	6	N/R	
Treatment room (p)	N/R	2	6	N/R	
Patient room (s)	N/R	2	6	N/R	

17

CAV to VAV Measures will require AHCA Approval

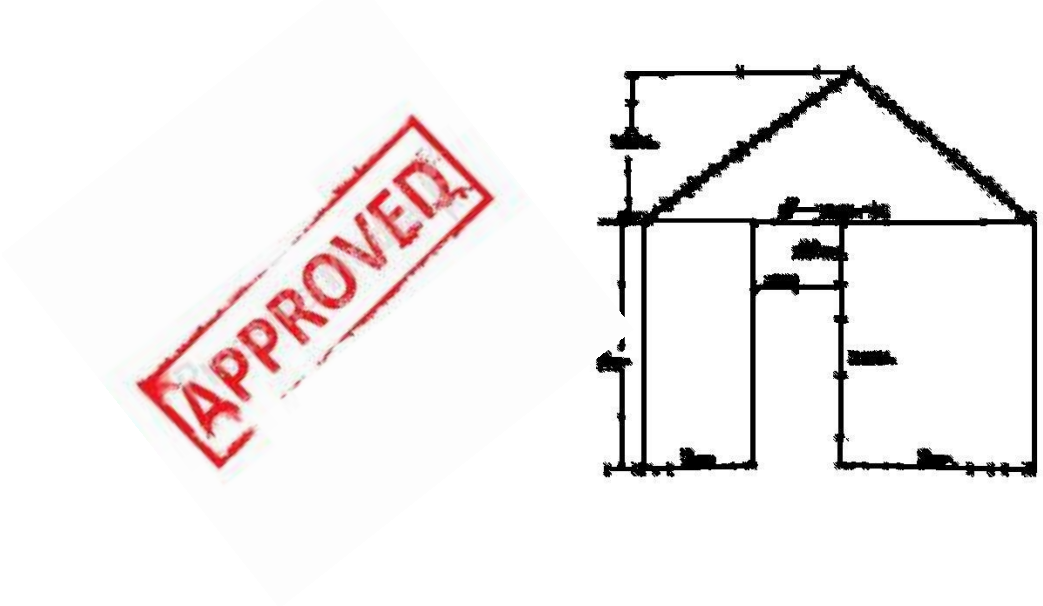
Desktop Review

Standup Review

CV to VAV Measures will require AHCA Approval

Standup Review

Construction Drawings



The Significance?

Fan Laws – The Power of Cube!

$$HP_2 = HP_1 (CFM_2/CFM_1)^3$$

If the average new variable CFM is **½** the constant old CFM, a 40 Horse Power Fan could be reduced to 5 Horse Power.

That translates to $**16,971** in savings

for 1 fan motor per year!

Fan Energy

*"A recent estimate places the worldwide energy use of fans at about **23%** of the world's total energy consumption."*

Select Fans Using Fan Total Pressure To Save Energy

By
John Cermak, Ph.D., P.Eng., Member ASHRAE;
and **John Murphy, Ph.D.,** Life Member ASHRAE
ASHRAE Journal, July 2011

The Solution

Approaches

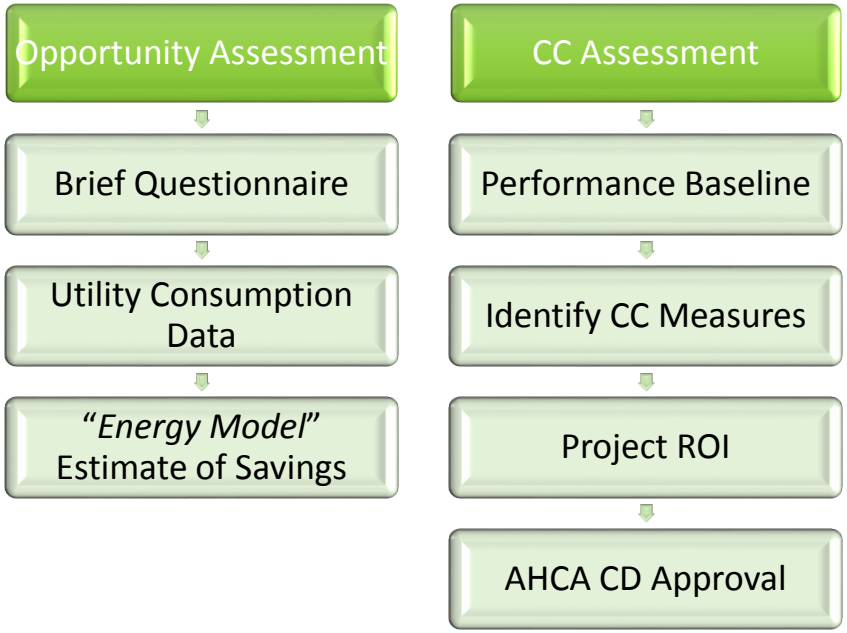
- ✓Audits
- ✓Re-Commissioning
- ✓Retro Commissioning
- ✓On-going Commissioning
- ✓Monitoring Based Commissioning
- ✓Automated Commissioning
- ✓Continuous Commissioning®

A Process/Plan to Get Started

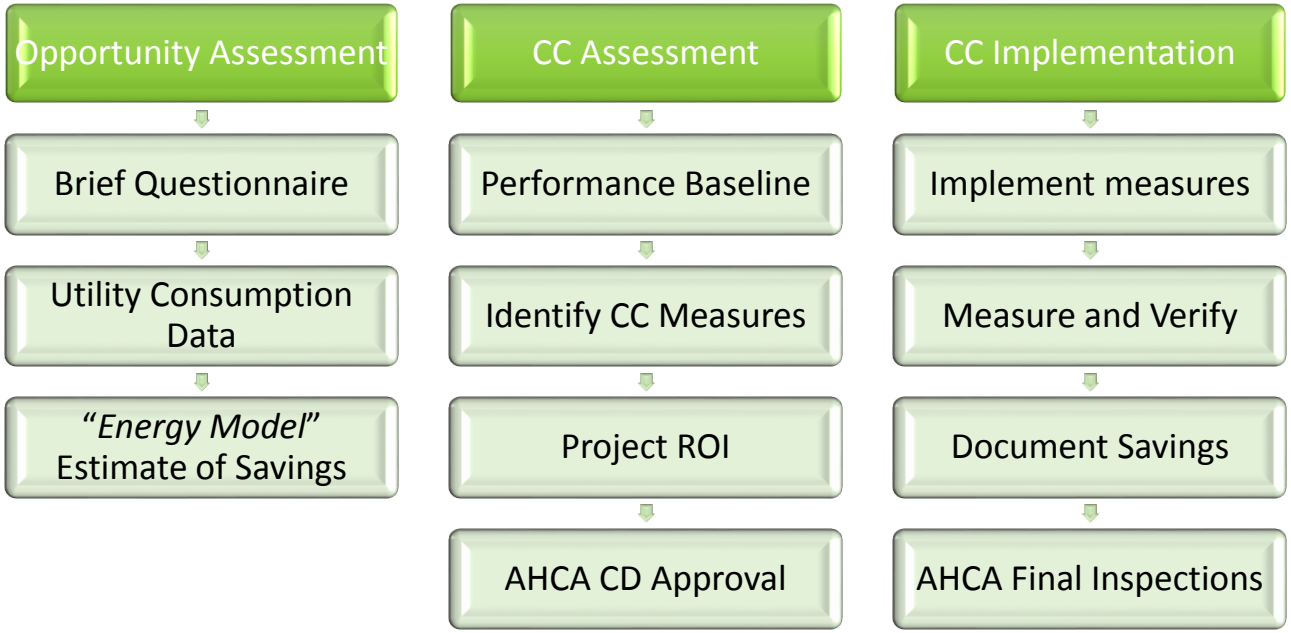
PHASES

- Opportunity Assessment
- Brief Questionnaire
- Utility Consumption Data
- *"Energy Model"* Estimate of Savings

PHASES


Opportunity Assessment
Brief Questionnaire
Utility Consumption Data
"Energy Model" Estimate of Savings
CC Assessment
Performance Baseline
Identify CC Measures
Project ROI
AHCA CD Approval

PHASES


Opportunity Assessment
Brief Questionnaire
Utility Consumption Data
"Energy Model" Estimate of Savings
CC Assessment
Performance Baseline
Identify CC Measures
Project ROI
AHCA CD Approval
CC Implementation
Implement measures
Measure and Verify
Document Savings
AHCA Final Inspections

PHASES

Opportunity Assessment	CC Assessment	CC Implementation	CC Persistence
Brief Questionnaire	Performance Baseline	Implement measures	Document Savings
Utility Consumption Data	Identify CC Measures	Measure and Verify	Identify additional opportunities
"*Energy Model*" Estimate of Savings	Project ROI	Document Savings	AFDD
	AHCA CD Approval	AHCA Final Inspections	

Baycare Health Systems
ST. Joseph's North Hospital
411,000 ft.^{2}

Opportunity Assessment	CC Assessment	CC Implementation	CC Persistence
Brief Questionnaire	Performance Baseline	Implement measures	Document Savings
Utility Consumption Data	Identify CC Measures	Measure and Verify	Identify additional opportunities
"Energy Model" Estimate of Savings	Project ROI	Document Savings	AFDD
	AHCA CD Approval	AHCA Final Inspections	

2013

Completed Early 2017

Approved April 2017

St Joe's Energy Star Score 4

St Joe's North Energy Use Index 314

Energy Star/Portfolio Manager EUI 196

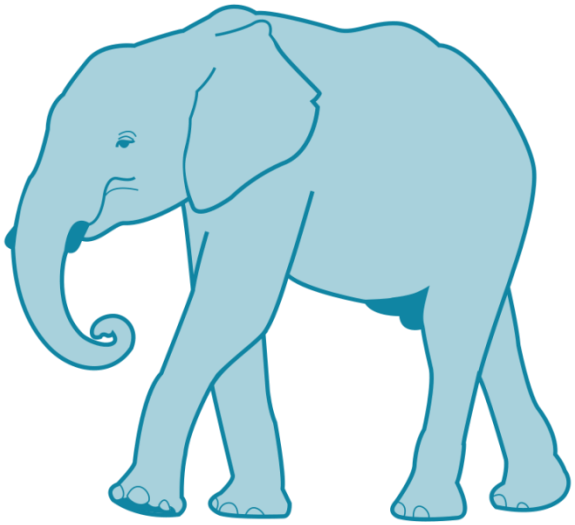
ENERGY STAR® PortfolioManager® Technical Reference

Broad Category	Primary Function	Further Breakdown (where needed)	Source EUI (kBtu/ft²)	Site EUI (kBtu/ft²)	Reference Data Source - Peer Group Comparison
Healthcare	Ambulatory Surgical Center		155.2	63.0	CBECS - Outpatient Healthcare
	Hospital	Hospital (General Medical & Surgical)*	389.8	196.9	CBECS - Inpatient Healthcare
		Other/Specialty Hospital			
	Medical Office*		116.7	44.4	CBECS - Medical Office

Energy was costing $4.02 ft.²

CC Measures Identified

- Boiler Plant
  - Reduce steam pressure
  - Improve HHWST reset sequence
- Chiller Plant
  - Reset CHWST setpoint
  - Improve CWST reset sequence
  - Improve Cooling Tower staging
- Air Handling Units
  - Convert selected AHUs from CAV to VAV
  - Improve SAT reset sequence
  - Reduce minimum outside airflow
  - Time of Day scheduling
  - Reset DSP to AHUs converted to VAV
- Terminal Units
  - Unoccupied space temperature setback
  - Dual-max VAV box controls



NO CAPITAL INVESTMENT

Phase I Assessment – AHCA

Energy, Cost & GHG Emissions Savings Estimates		
	CC Assessment	AHCA-Approved Design
Potential Annual Electricity Use Savings	3,993,606 kWh/yr	3,170,706 kWh/yr
Potential Annual Natural Gas Savings	177,075 Therms/yr	175,438 Therms/yr
Potential Annual Site Energy Savings	31,334 MMBtu/yr	28,362 MMBtu/yr
Potential Annual Energy Cost Savings	$395,863/yr	$334,914/yr
Potential Annual Greenhouse Gas Emissions Reduction	3,162 MtCO2e/yr	2,696 MtCO2e/yr

Phase I Assessment - Review

CC Assessment

Performance Baseline

Identify CC Measures

Project ROI

2012-13 Findings	
O&M Items	136
Energy Expenditure	$1,654,140
Energy Usage	128,995 MBtu/yr
Energy Use Intensity	314 kBtu/ft^2
Energy Star Score	4
Potential Savings	
CC Opportunities	12
Energy Savings	19.5%
Cost Savings	$334,914
Simple Payback	1.41 years
Return On Investment	71.10%
Energy Star Target	36

Implementation

Case Study: Impact

- Air Quality/Patient Comfort

✓ Solved condensation problems

✓ Resolved air infiltration problem on back loading dock

✓ Eliminated simultaneous heating and cooling

✓ Identified Building Envelope issues and consulting on plan to resolve and return patient rooms to usability

- Benefits

✓ AHU's
  - Static reset
  - Discharge air reset
  - Night setback

✓ VAV terminal boxes
  - CV to VAV – adjusting minimum flow

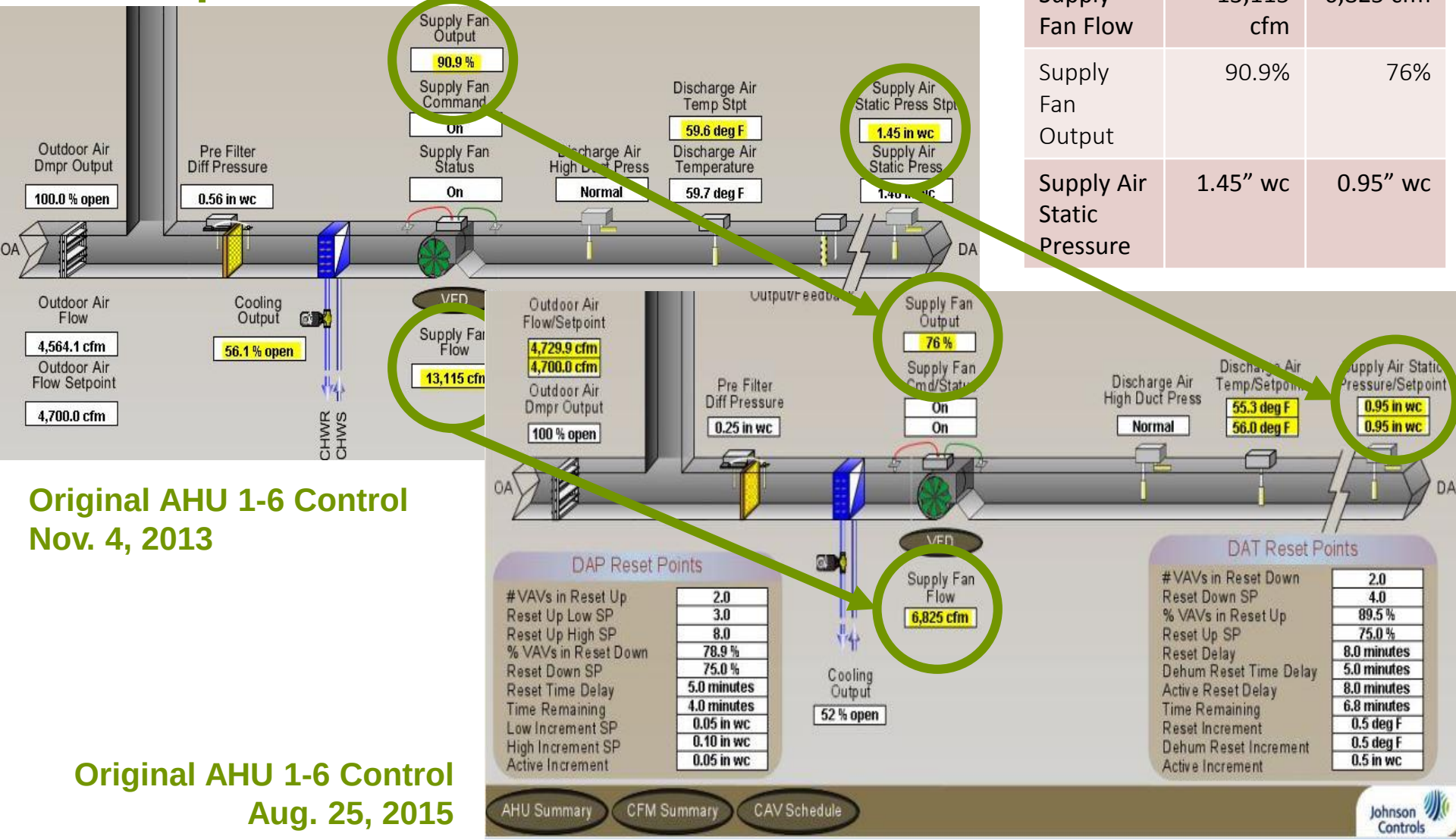
✓ Chiller Optimization
  - Less bypass
  - Reduced flow
  - Reduced tonnage

✓ Heat Exchanger Optimization

Case Study: Impact

AHU Optimization

	Before	After
Supply Fan Flow	13,115 cfm	6,825 cfm
Supply Fan Output	90.9%	76%
Supply Air Static Pressure	1.45” wc	0.95” wc



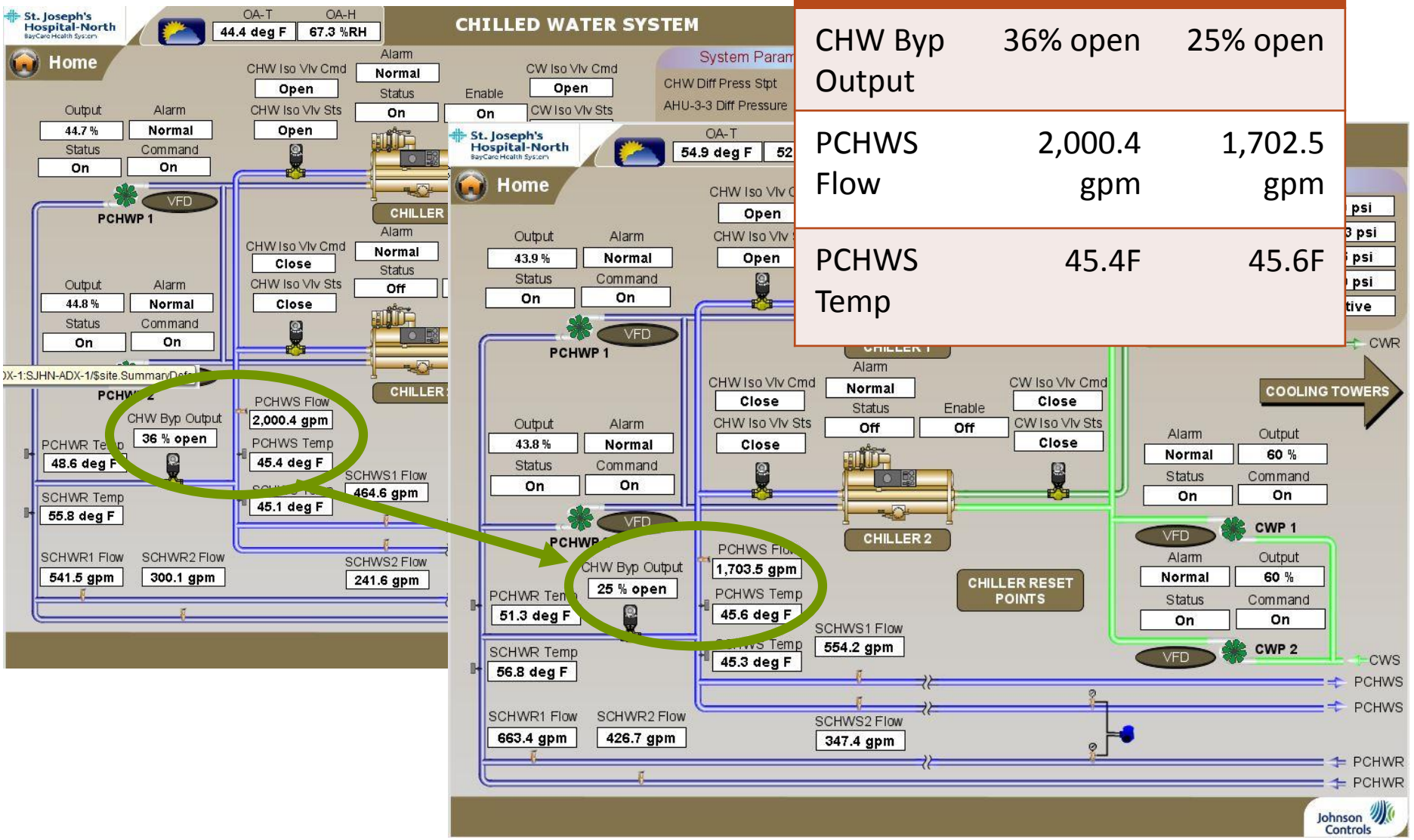
Original AHU 1-6 Control
Nov. 4, 2013

Original AHU 1-6 Control
Aug. 25, 2015

Case Study: Impact

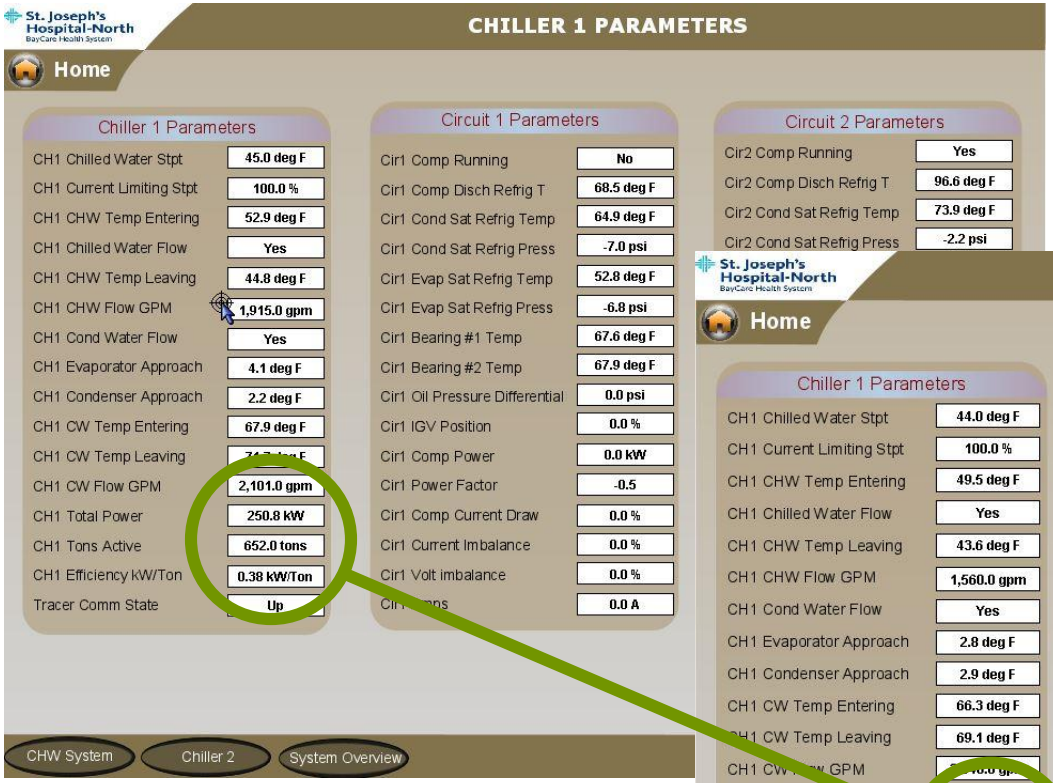
Chiller Optimization

	Before	After
CHW Byp Output	36% open	25% open
PCHWS Flow	2,000.4 gpm	1,702.5 gpm
PCHWS Temp	45.4F	45.6F

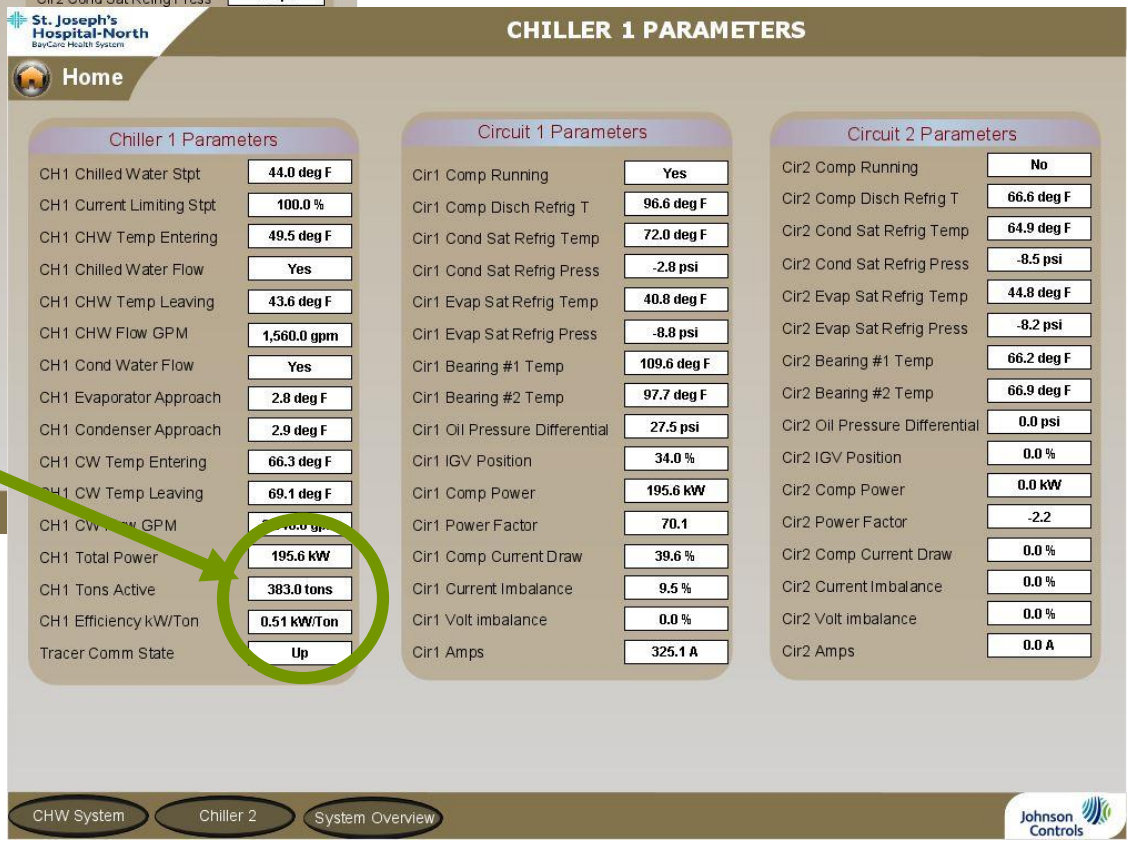


Case Study: Impact

Chiller Optimization

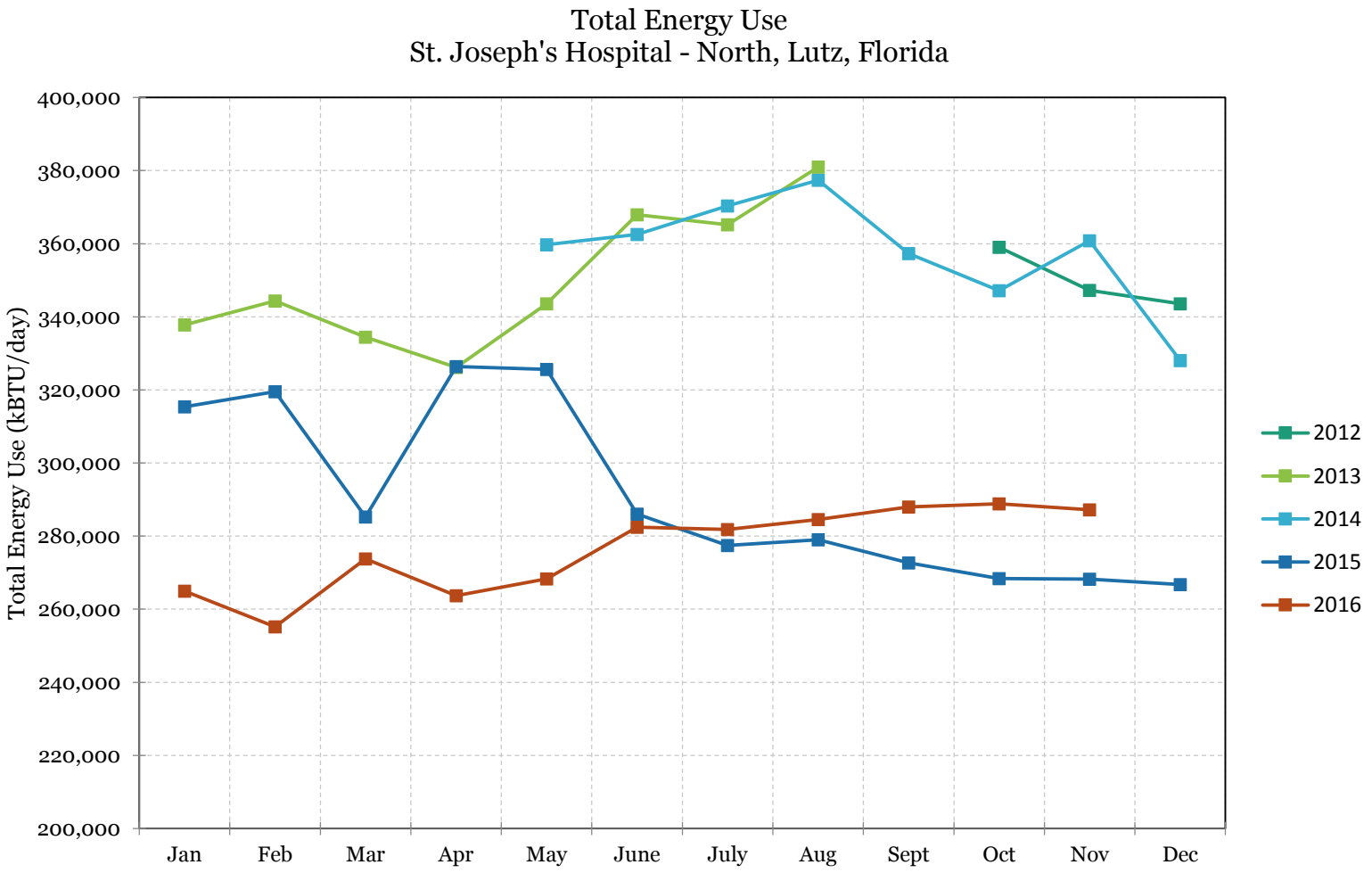


	Before	After
Tonnage	652.0 tons	383.0 tons

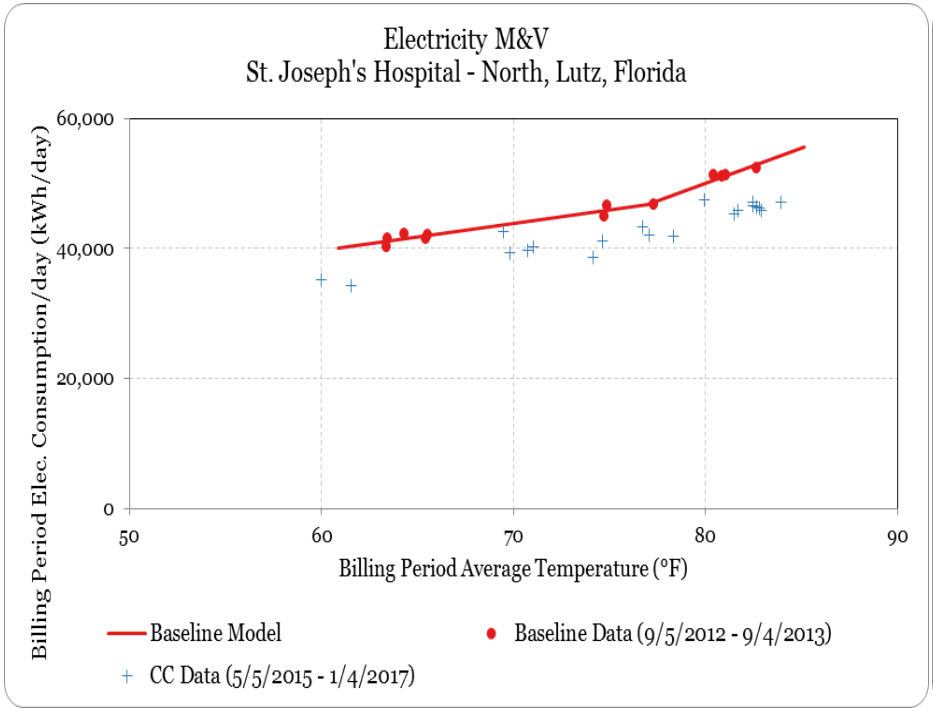


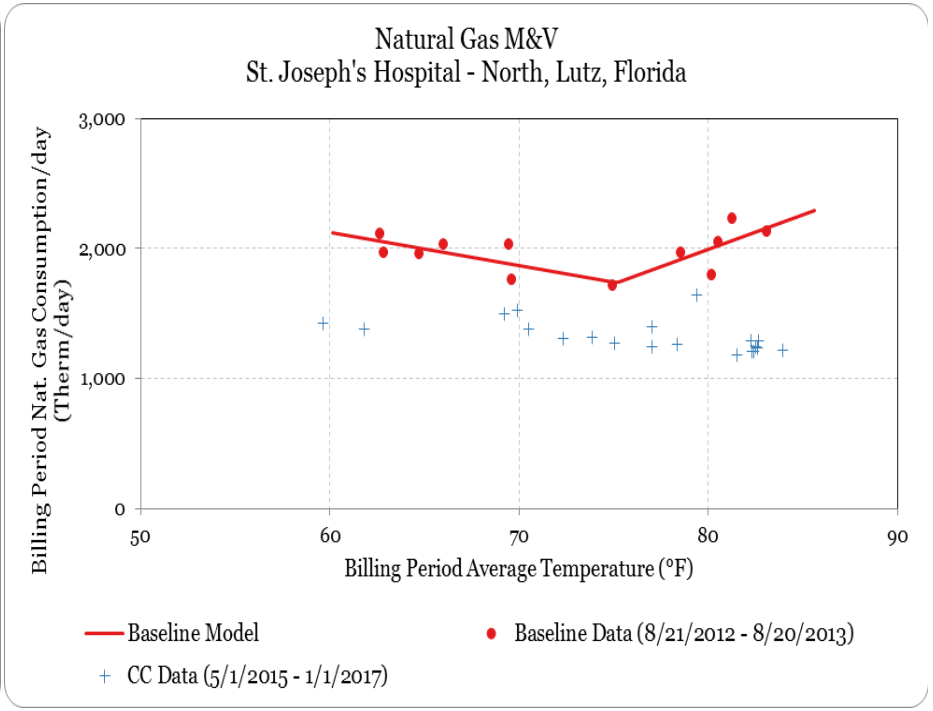
RESULTS

Results -- 2012 thru December 2016

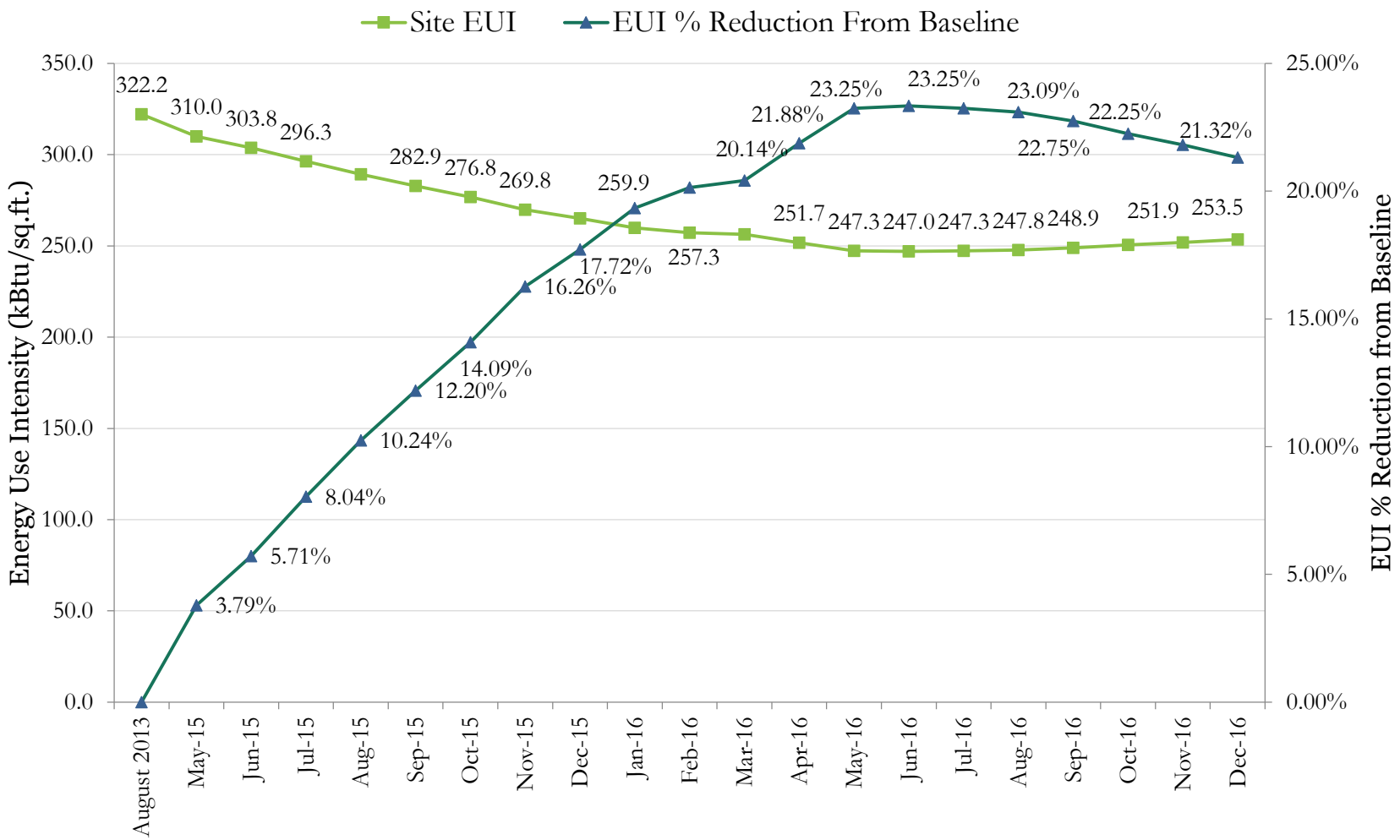


Results -- Consumption Reduction

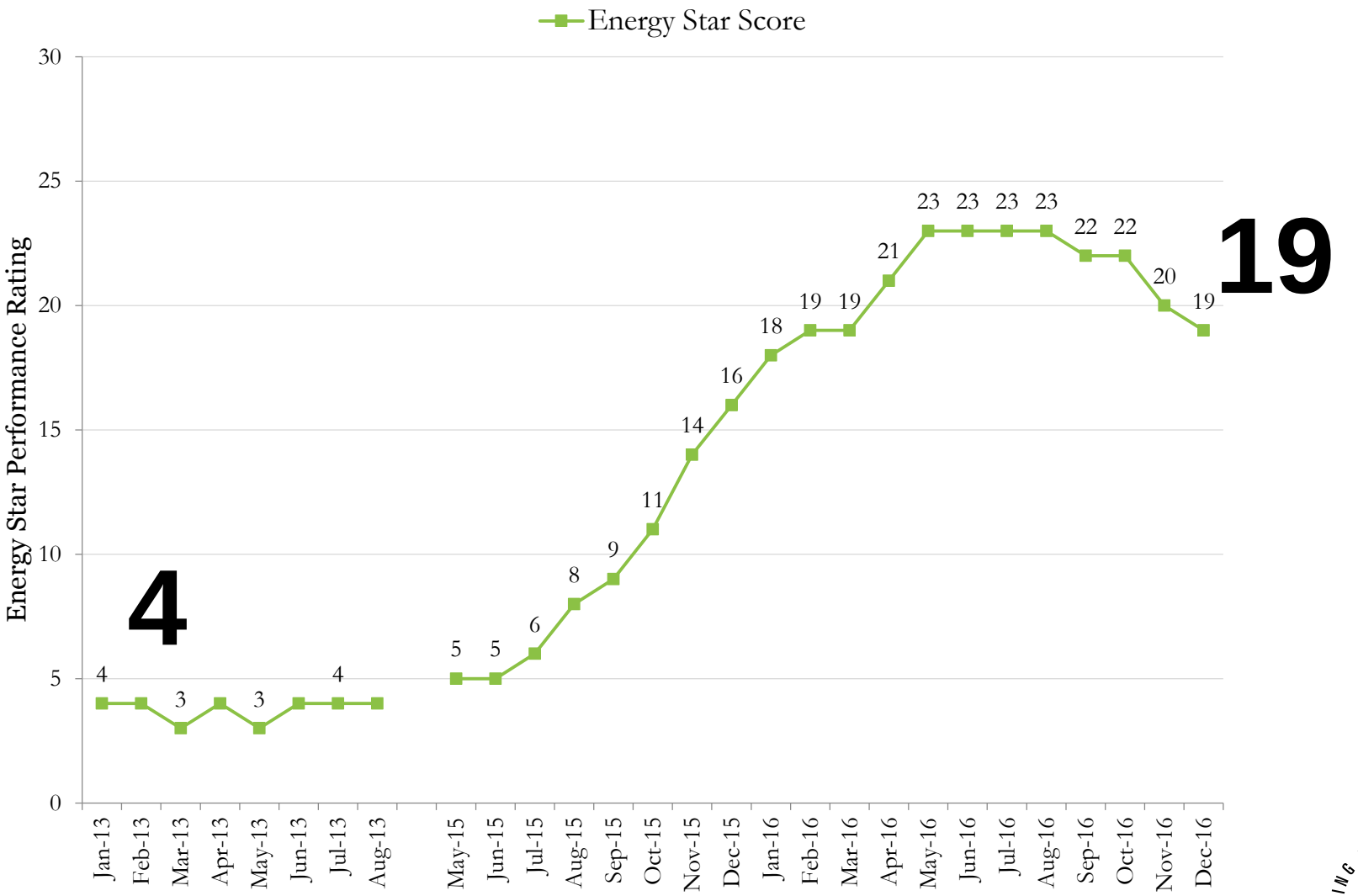




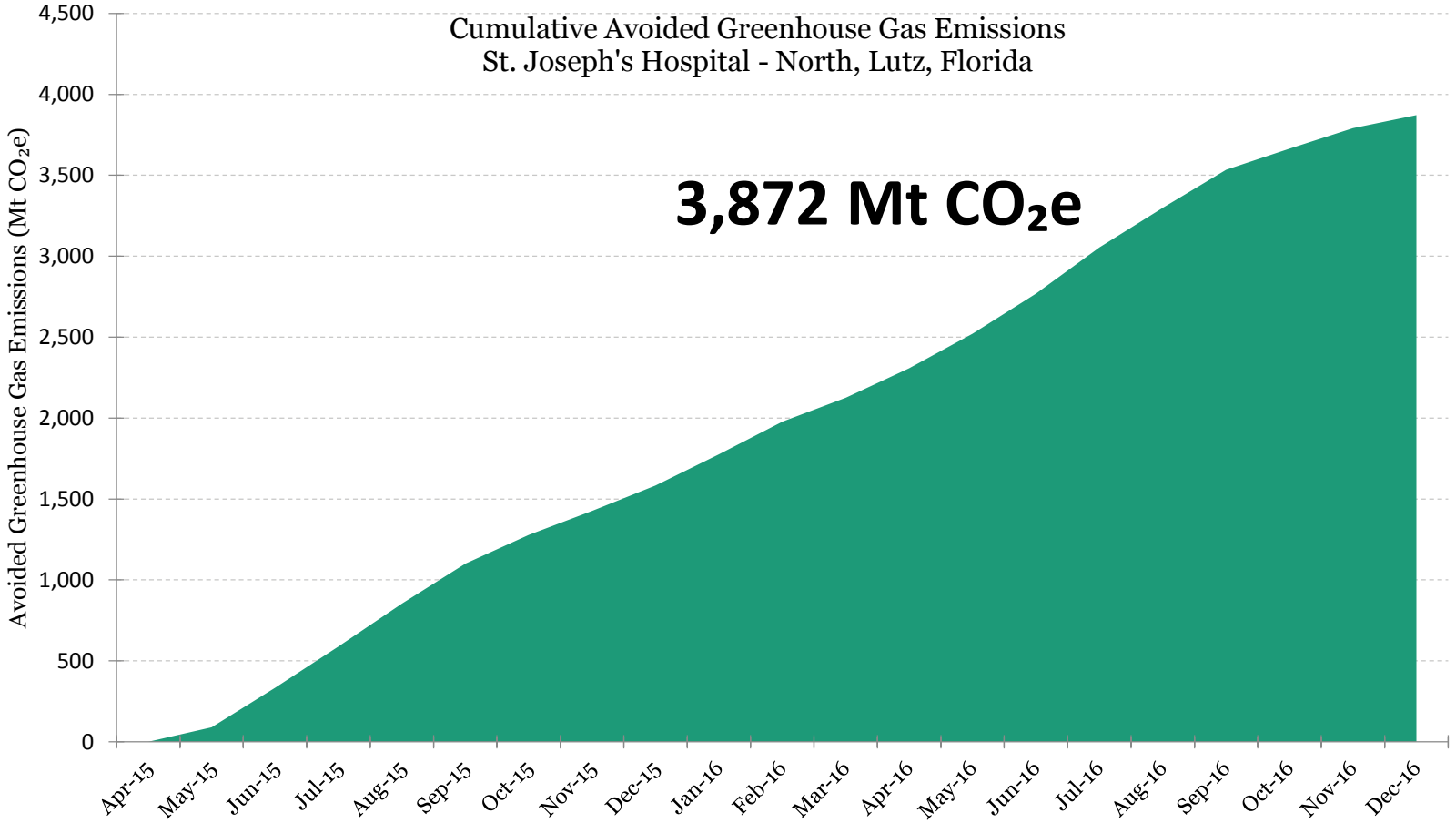
Results -- EUI 322 >253.5



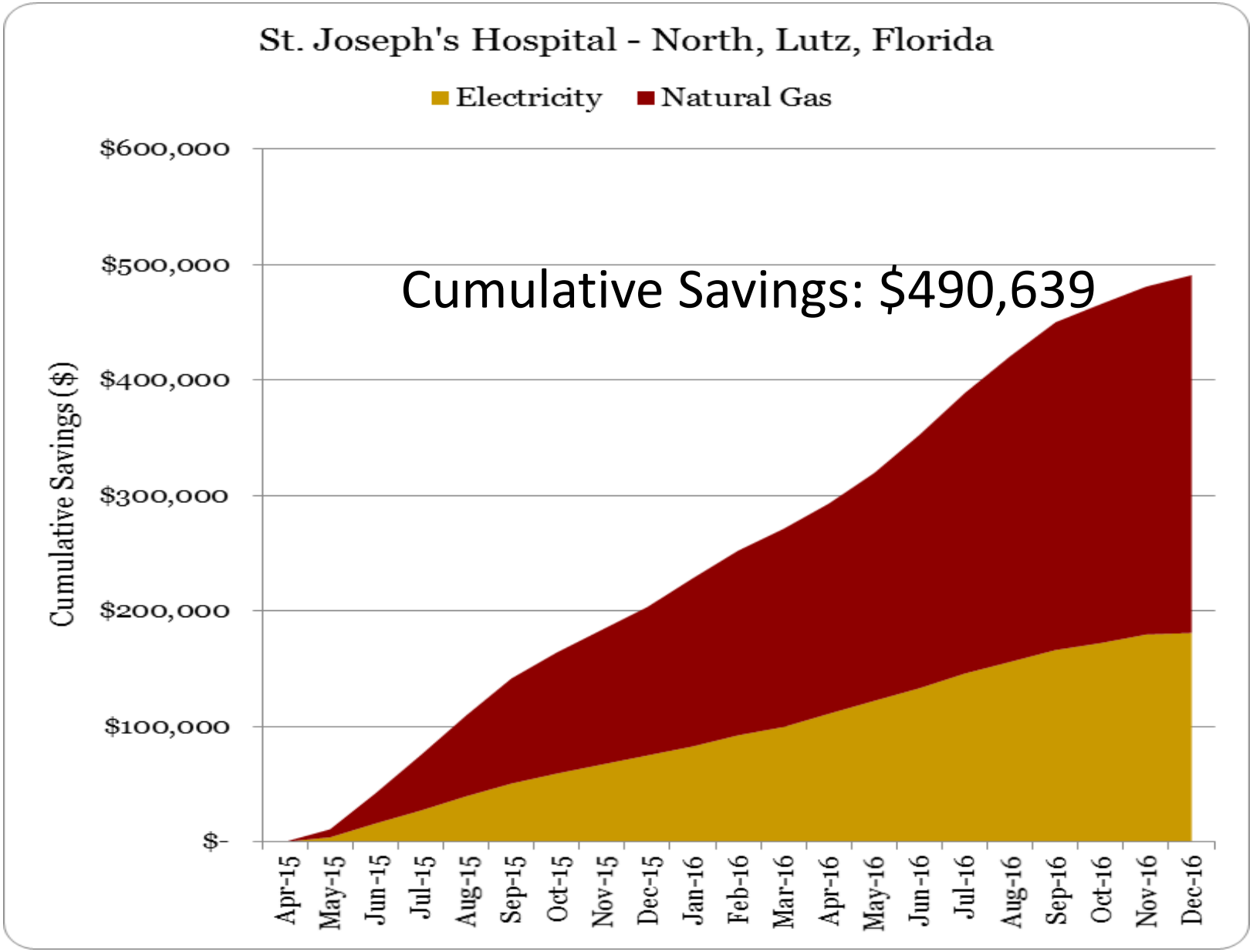
Results -- Energy Star Score 4 > 19



Greenhouse Gas Reduction



Results -- $$$$ -- thru December 2016



Final Analysis – So Far!!

Energy Model Savings Projections

- ✓ Cost Savings $334,914
- ✓ Simple Payback 1.41 years
- ✓ ROI 71.10%

Latest 12 Months Annual Savings

- ✓ Cost Savings $309,000
- ✓ Simple Payback 1.60 years
- ✓ ROI 62.50%

Final Inspection and Approval !!

RICK SCOTT
GOVERNOR

ELIZABETH DUDEK
SECRETARY

November 2, 2015

Mr. Robert Proodian
St Joseph's Hospital North
4211 Van Dyke Rd
Lutz, FL 33558

Re: Facili[illegible]ame: St Joseph's Hospital North
Pro[illegible]t Name: HVAC Controls Optimiza[illegible]
C[illegible]nt Code/File-Project Sub. Numbe[illegible]23[illegible]100-[illegible]

Dear Mr. P[illegible]dian:

On J[illegible] 29, 2015, an onsite constructio[illegible]y [illegible] conducted of the referenced pr[illegible]t and is approved for its intended pu[illegible]hout further comment by the A[illegible]ncy. This project is considered[illegible]ted by [illegible]Agency, and a project review voice will be prepared for final p[illegible]ment.

One set of construction documen[illegible]ong wit[illegible]e project correspondence file for[illegible]s project will be archived for five[illegible]rs. A[illegible]ther previously submitted doc[illegible]nts regarding this project wi[illegible]tro[illegible]

If you have questio[illegible]on[illegible]g this review, please contact M[illegible] Slazinski architectural reviewer; Da[illegible]mechanical reviewer; or Rudy T[illegible]es, electrical reviewer, as app[illegible]e at[illegible]hone (407) 420-2504.

Sincerely,

Marc[illegible]
Office o[illegible]ns and Construction
Tel: (407)[illegible]2504/Fax: (407) 317-7182
[illegible]Slazin[illegible]@ahca.myflorida.com

[illegible]Qui[illegible]

[illegible]: Via Email Smith Seckman R[illegible], Inc.

APPROVED

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CONTINUING EDUCATION AIA

Staff Survey Results

- Comfort
- Project Awareness
- What's important?
  - Environment
  - Energy
  - Dollars

This concludes The American Institute of Architects
Continuing Education Systems Course

Steve Harrell, CEM, CxA

Principal

SSRCx

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