

Facilities Services

COVE Presentation - HVAC

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September 19, 2019

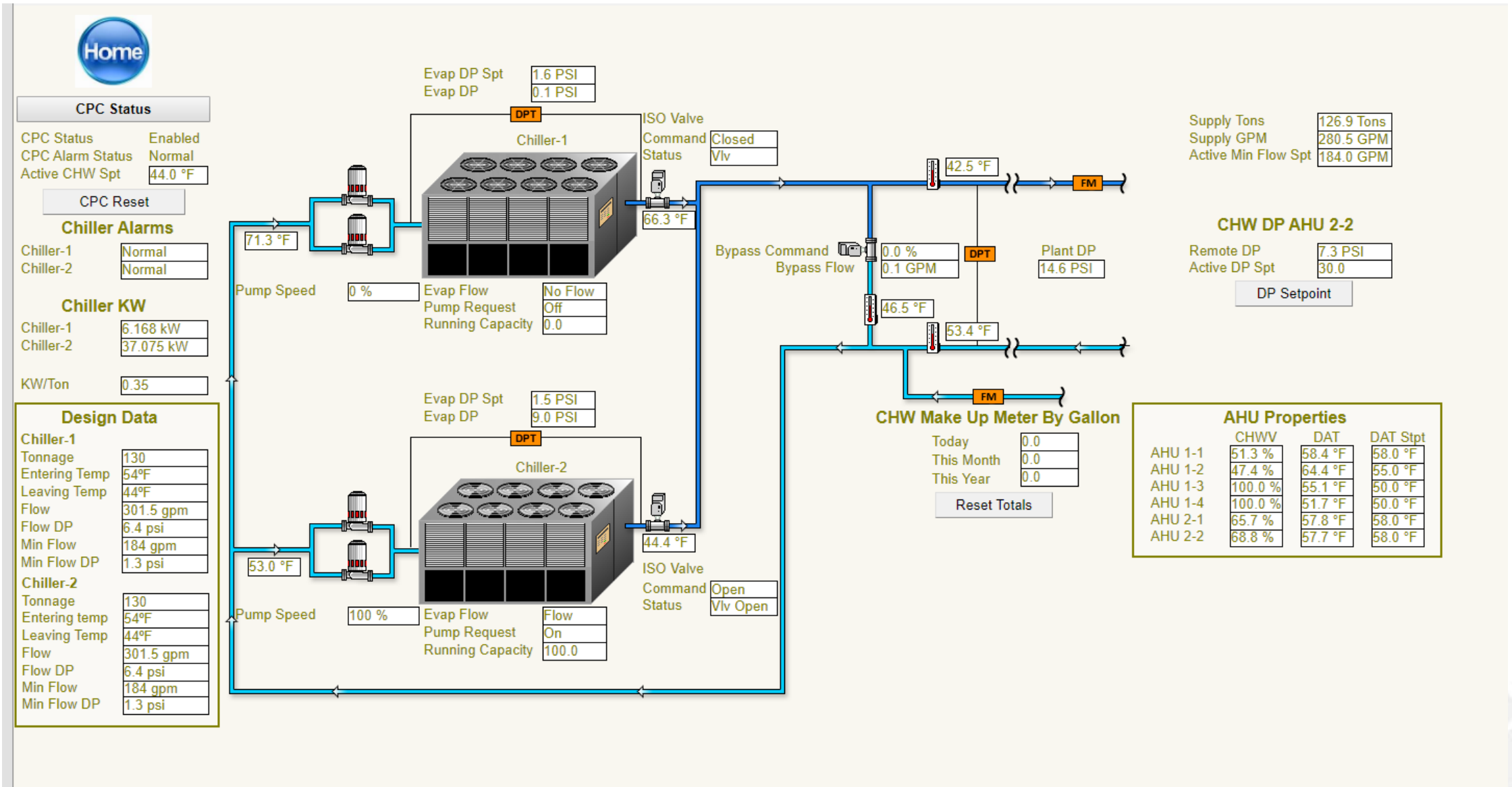


**Orange County
Public Schools**

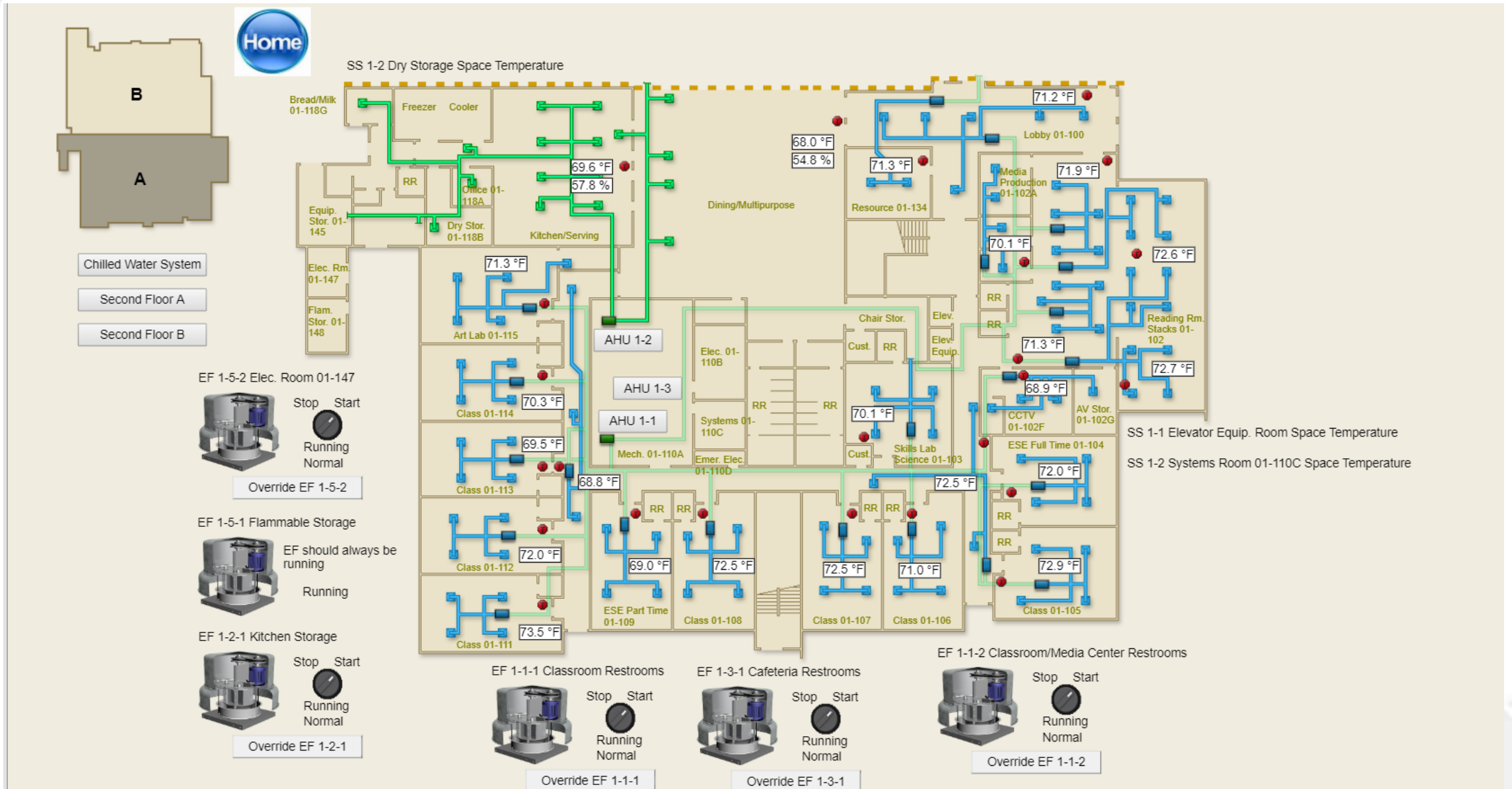
Agenda

- OCPS HVAC Design
- Commissioning of HVAC Systems
- Capital Renewal HVAC Program Overview
- Capital Renewal Planning Process
- Project Examples
- HVAC Lessons Learned


OCPS HVAC Design – Chilled Water



OCPS HVAC Design – Air Distribution



OCPS HVAC Design – Air Handling Unit



- Chilled Water System
- First Floor Area A
- First Floor Area B
- Second Floor A
- Second Floor B

AHU Information

Heat Cool Mode	Dehumidify
Space Temperature	72.1 °F
Space Setpoint Active	72.0 °F
Space Humidity	54.7 %
Mixed Air Temp	73.0 °F

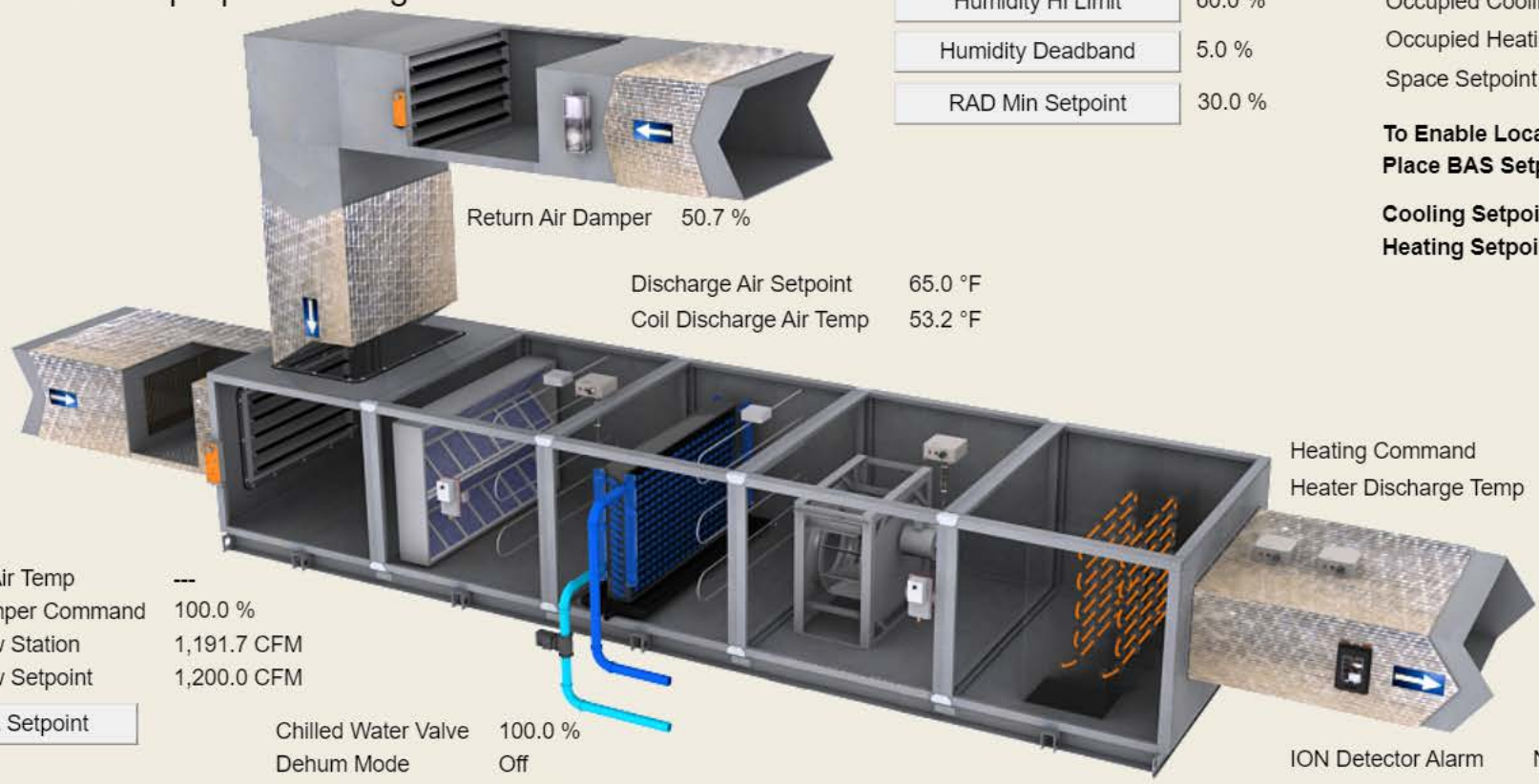
User Adjustable Setpoints

Occupancy	Occupied
Hi Occupancy	On
Space Setpoint BAS	72.5 °F
Occupied Offset	1.5 °F
Humidity Hi Limit	60.0 %
Humidity Deadband	5.0 %
RAD Min Setpoint	30.0 %

Serves Multipurpose/Dining Room

Outside Air Temp	---
OSA Damper Command	100.0 %
OSA Flow Station	1,191.7 CFM
OSA Flow Setpoint	1,200.0 CFM

OSA Setpoint



Return Air Damper 50.7 %

Discharge Air Setpoint 65.0 °F
Coil Discharge Air Temp 53.2 °F

Heating Command 92.1
Heater Discharge Temp

ION Detector Alarm Normal

Supply Fan Normal

Cooling Hi Limit	77.0 °F
Cooling Low Limit	74.0 °F
Heating Hi Limit	72.0 °F
Heating Low Limit	72.0 °F
Occupied Cooling Setpoint	74.0 °F
Occupied Heating Setpoint	72.0 °F
Space Setpoint Local	

**To Enable Local Thermostat Control
Place BAS Setpoint Out Of Service**

**Cooling Setpoint Is Setpoint BAS + Occupied Offset
Heating Setpoint Is Setpoint BAS - Occupied Offset**

Chilled Water Valve	100.0 %
Dehum Mode	Off
Freeze Alarm	Normal

OCPS HVAC Design – VAV Box



VAV 2-1-03 Rm 213

Override

Schedule

Occupied

Active Mode

Cool

Space Temperature

73.5 °F

Space Temp Setpoint BAS

72.5 °F

Occupied Offset

1.5 °F

Space Setpoint Active

74.0 °F

Setpoint BAS

Occ Offset

To Enable Local Thermostat Control
Place BAS Setpoint Out Of Service

Cooling Setpoint Is Setpoint BAS + Occupied Offset
Heating Setpoint Is Setpoint BAS - Occupied Offset

First Floor Area A

First Floor Area B

Second Floor A

Second Floor B

Air Valve
42.2 %

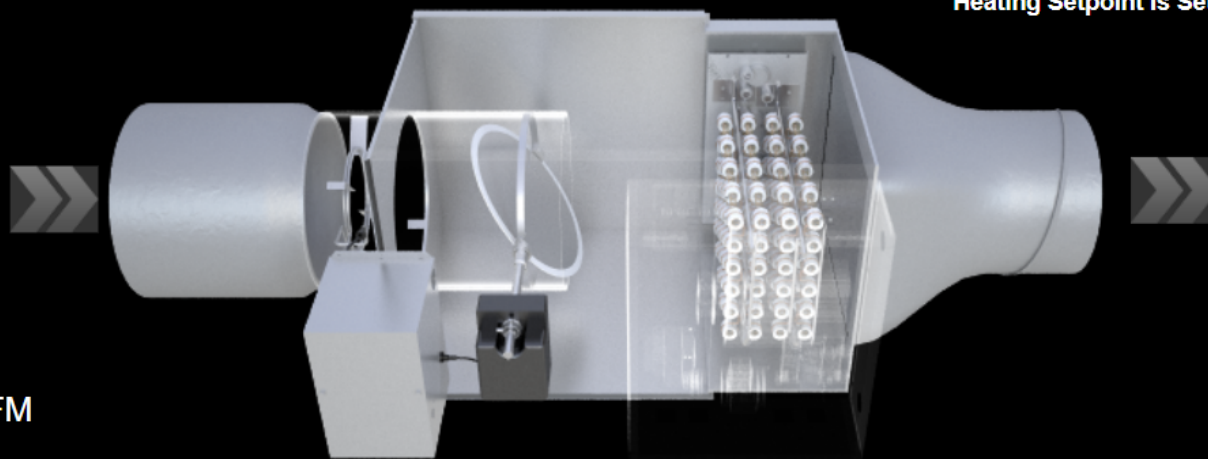
Air Flow
361.8 CFM

Air Flow Setpoint
338.5 CFM

Inlet Temp
56.9 °F

Heating Output
0.0 %

Outlet Temp
58.1 °F

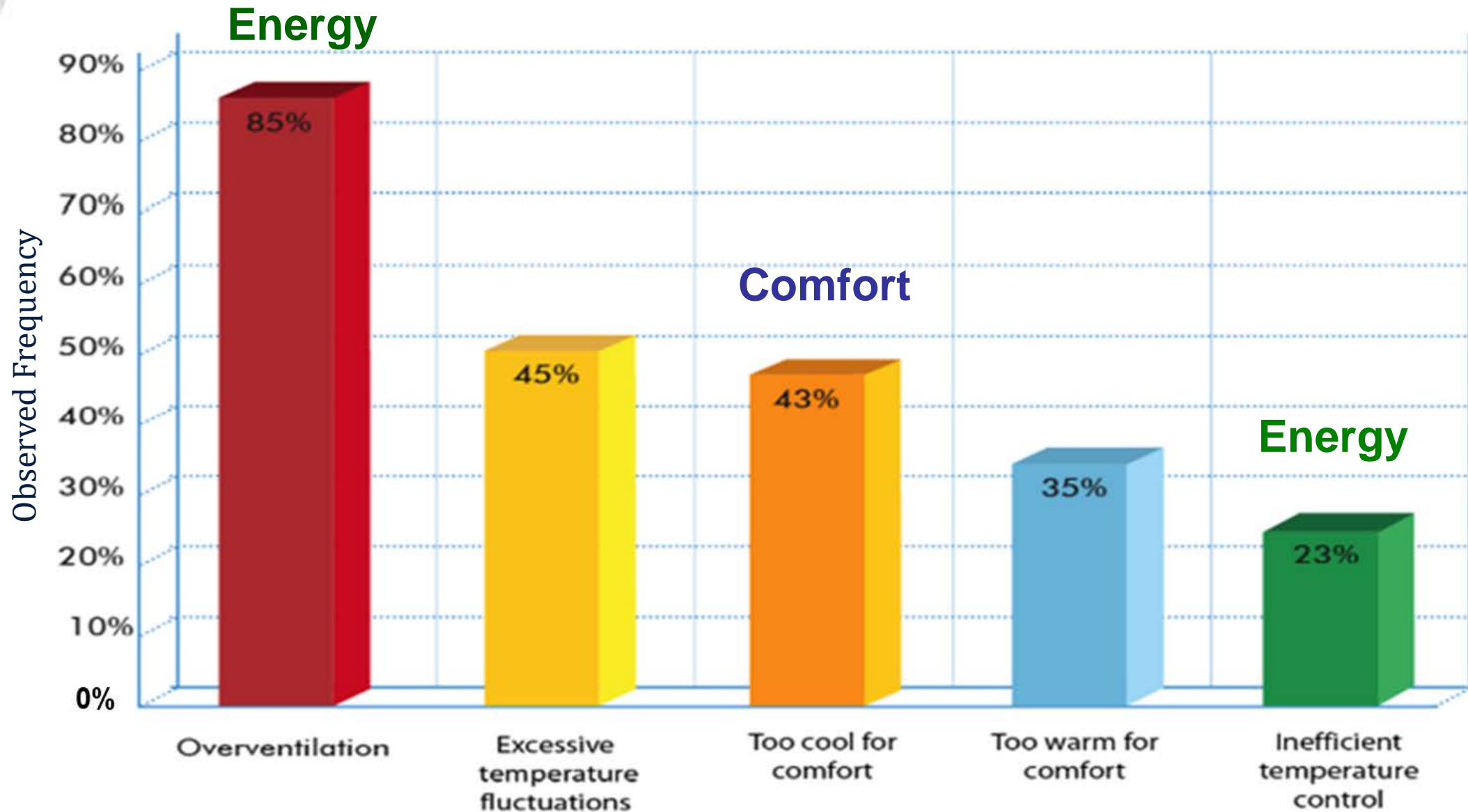


Commissioning



Commissioning is the process of ensuring that Mechanical and associated systems are designed, installed, functionally tested, and capable of being operated and maintained according to the OCPS's operational needs.

Commissioning – HVAC Issues Affecting Buildings



Commissioning - Benefits

- Ensures compliance with design intent
- Provides early detection of potential problems
- Reduces change orders, claims and contractor call backs
- Calibrates HVAC systems and controls to ensure system optimization
- Reduces operation and maintenance costs
- Reduces potential for Indoor Air Quality problems
- Provides healthy and comfortable work environment
- Improves student/occupant productivity

Commissioning - Phases

- Pre-Design
- Design / Bidding
- Construction
- Acceptance
- Post-Acceptance (Occupancy and Operation)



Commissioning – Top Findings

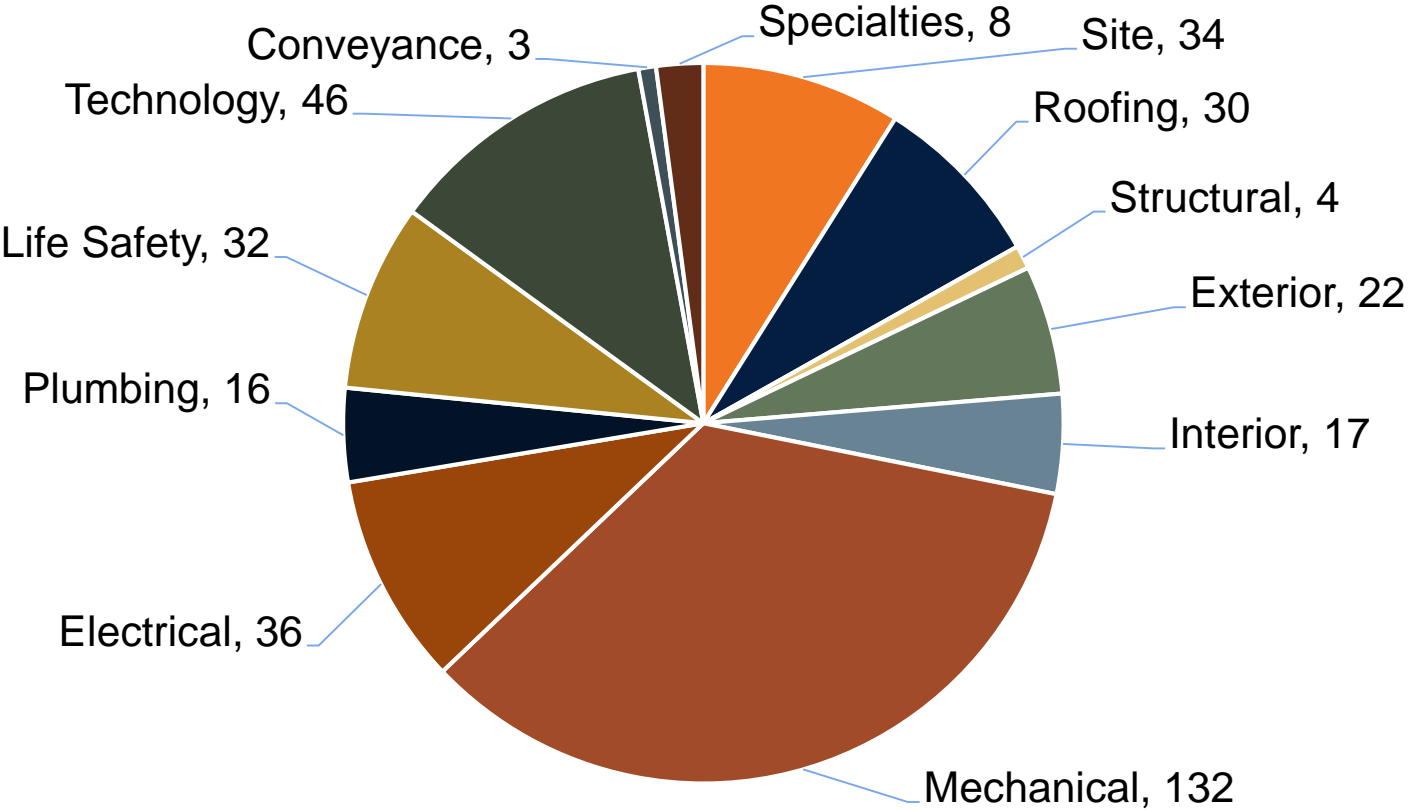
- Incorrect Test and Balance report flows
- Sensors not calibrated
- Building Automation System (BAS) graphic displays incorrect
- Humidity control not functioning
- Incorrect outdoor air control
- Simultaneous heating and cooling
- Electric reheat coils not working properly
- Supply air temperature reset not functioning
- CO2 Demand Control Ventilation (DCV) not working
- Static pressure reset controls not functioning
- Chillers not staging properly
- Unoccupied mode not functioning
- Incorrect lighting control operation

Capital Renewal (CR) HVAC Projects

- 132 total w/ mechanical system
 - 67 chillers only (Replace & R'newal)
 - 5 cooling towers only (Replace & Rebuild)
 - 38 campus-wide
 - 22 partial campus
- } 14 included chiller scope

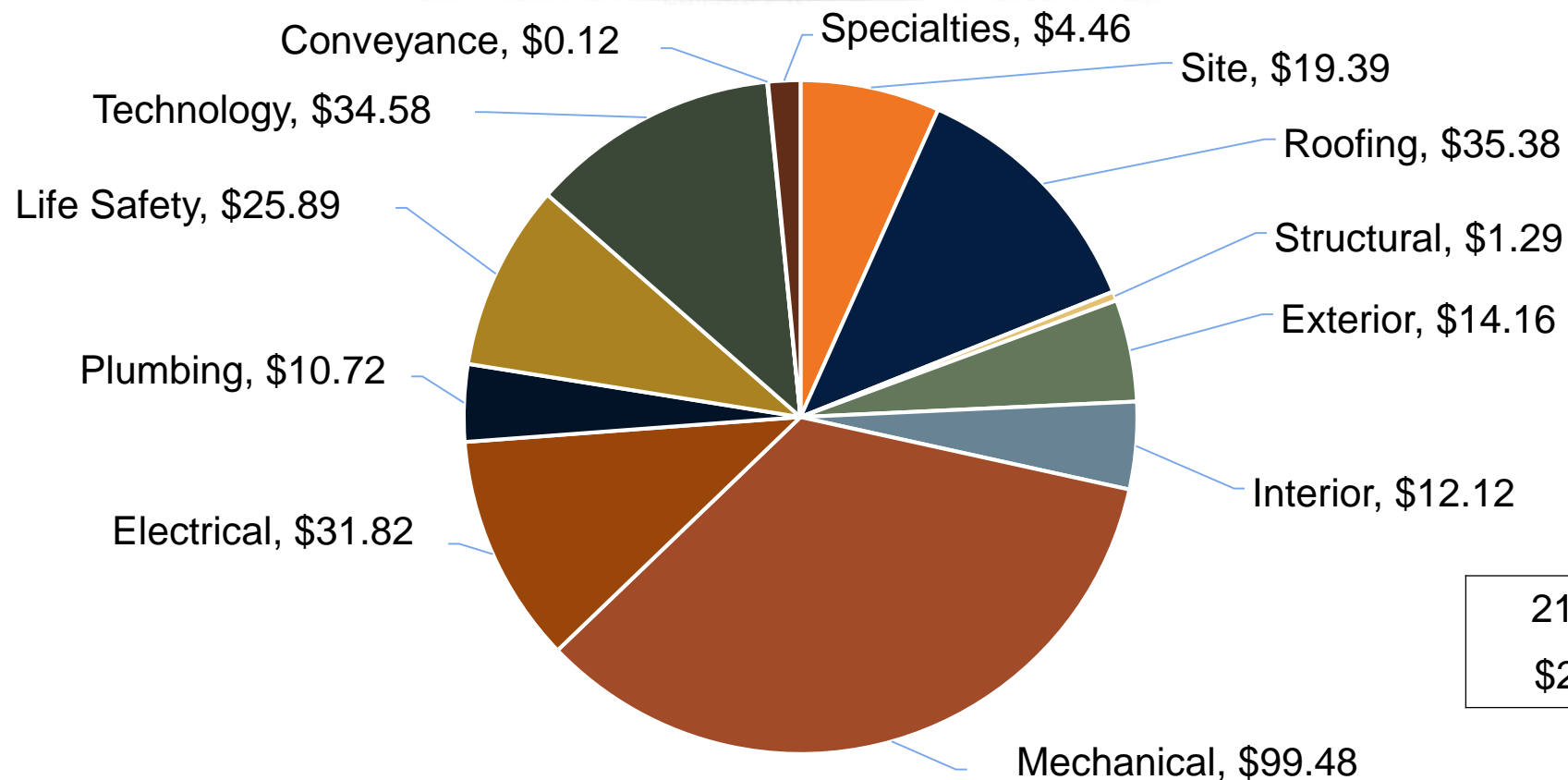
210 Total Projects
380 Total Elements

CR Project Elements (total active and completed)



210 Total Projects
380 Total Elements

CR Project Cost by Element (\$millions)



Capital Renewal Planning

Tentative
Project
Identification



Scope
Validation



Detailed Scope
Development



Project
Delivery



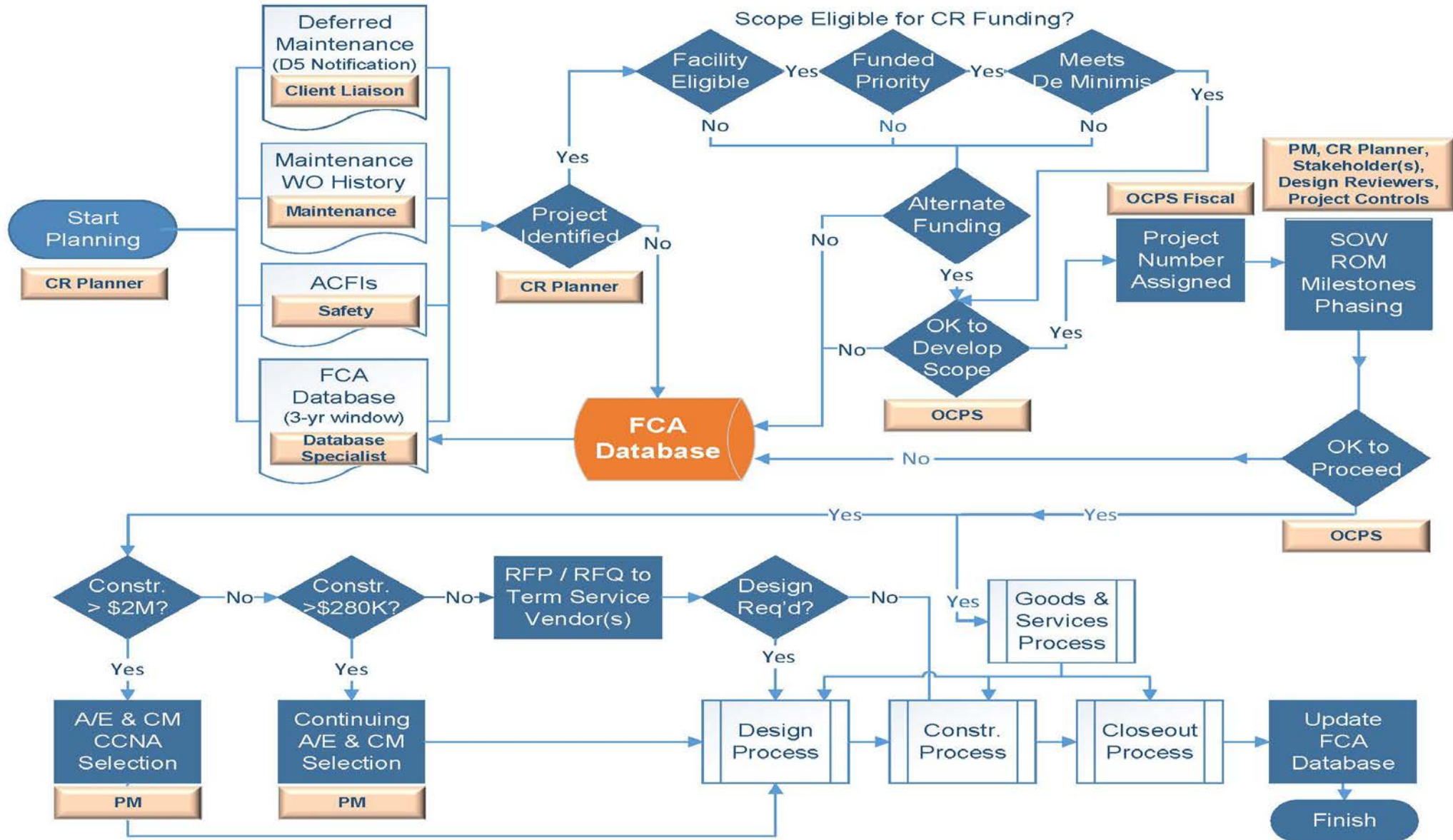
- Deferred Maintenance Notifications
- ACFI (Safety) Reports
- FCA Database (3-Yr Window)
- Maintenance Validation
- OCPS Approval

- Program Management Team Assessment

- Third Party Investigations
 - Retro-commissioning
 - Envelope Assessment
 - Geotechnical Investigation
- PM Team Detailed Scope Development
- OCPS Approval

- A/E & CM Selection
- Design
- Construction
- Close-Out
- Update FCA Database

Capital Renewal Planning



Useful Life of HVAC Subsystems

- Air Handling Units
 - Indoor 25-yrs
 - Outdoor 15-yrs
- Boilers 25-yrs
- Chillers
 - Indoor, water cooled 30-yrs (10-yrs R'newals)
 - Outdoor, air cooled 15-yrs
- Controls
 - BAS 25-yrs
 - Electronic 15-yrs

Useful Life of HVAC Subsystems

- Cooling Towers 30-yrs (10-yrs Rebuilds)
- Ductwork 30-yrs
- Exhaust Fans
 - Indoor 25-yrs
 - Outdoor 15-yrs
- O/S Air Dampers 15-yrs
- Pumps 25-yrs
- VAVs, FTBs 25-yrs
- VFDs 25-yrs

HVAC Project Planning – FCA Database

Facility	Bldg. No.	Priority Group	System	Sub System Type / Deficiency Description	Rem Life	Total Cost	LC Def	CR Pty
Glenridge MS	01	Pty 1-3	Mechanical	Controls - DDC (Bldg.SF)	1	\$19,649	no	1
Glenridge MS	01	Pty 1-3	Mechanical	Exhaust Fan	1	\$4,109	no	2
Glenridge MS	02	Pty 1-3	Mechanical	Controls - DDC (Bldg.SF)	1	\$26,494	no	1
Glenridge MS	02	Pty 1-3	Mechanical	Exhaust Fan	1	\$8,219	no	2
Glenridge MS	02	Pty 1-3	Mechanical	Outside Air Cooled Condenser	1	\$14,911	no	1
Glenridge MS	02	Pty 1-3	Mechanical	Split DX Unit	1	\$10,715	no	1
Glenridge MS	03	Pty 1-3	Mechanical	Controls - DDC (Bldg.SF)	1	\$40,844	no	1
Glenridge MS	03	Pty 1-3	Mechanical	Exhaust Fan	1	\$8,219	no	2
Glenridge MS	04	Pty 1-3	Mechanical	Controls - DDC (Bldg.SF)	1	\$53,208	no	1
Glenridge MS	04	Pty 1-3	Mechanical	Exhaust Fan	1	\$8,219	no	2
Glenridge MS	05	Pty 1-3	Mechanical	Controls - DDC (Bldg.SF)	1	\$32,287	no	1
Glenridge MS	05	Pty 1-3	Mechanical	Cooling Tower - Metal (400 Tons)	1	\$1,060	no	1
Glenridge MS	05	Pty 1-3	Mechanical	Cooling Tower - Metal (400 Tons)	1	\$1,060	no	1
Glenridge MS	05	Pty 1-3	Mechanical	Exhaust Fan	1	\$22,602	no	2
Glenridge MS	05	Pty 1-3	Mechanical	Outside Air Cooled Condenser	1	\$14,911	no	1
Glenridge MS	05	Pty 1-3	Mechanical	Split DX Unit	1	\$10,715	no	1
Glenridge MS	06	Pty 1-3	Mechanical	Controls - DDC (Bldg.SF)	1	\$172,432	no	1
Glenridge MS	06	Pty 1-3	Mechanical	Exhaust Fan	1	\$16,438	no	2
Glenridge MS	06	Pty 1-3	Mechanical	Outside Air Cooled Condenser	1	\$14,911	no	1
Glenridge MS	06	Pty 1-3	Mechanical	Split DX Unit	1	\$10,715	no	1
Glenridge MS	05	Pty 1-3	Mechanical	Circulation Pump Requires Replacement	0	\$46,028	yes	1
Glenridge MS	05	Pty 1-3	Mechanical	Circulation Pump Requires Replacement	0	\$94,169	yes	1
Grand Total						\$631,914		

Capital Renewal HVAC Scope Considerations

- Upgrade to current design guideline
- Consider refurbishment of AHUs, chillers, cooling towers
- Convert to air cooled chillers in lieu of water cooled
- Convert direct exchange (DX) systems to chilled water when feasible
- Convert hot water heating systems to electric heat
- Move equipment off roof
- Replace fan terminal boxes with VAV boxes

Chiller R'newal

- Indoor Water-Cooled Chillers
 - 30-year useful life (versus 15-year life for outdoor air-cooled chillers)
 - Requires R'newal every 10-12 years
 - Typical cycle – install, two (2) r'newals, replace
 - MAPPS™ forecasts r'newals at 10 and 20 years
 - Cooling Towers on a similar install, two (2) retrofits, replace cycle
- Trane Trademarked R'newal™ Service
 - Replaces/restores major components, including: coils, compressor, pumps & motors, gaskets & seals, refrigerant, control panel, insulation & jackets
 - Start-up, operation check, 5-year flange-to-flange material & labor warranty

Chiller R'newal



Cooling Tower Refurbishment



Cooling Tower Replacement



Air Cooled Chiller Replacements



Air Cooled Chiller Replacements



Pump Replacements



Pump Replacements



Piping Replacements



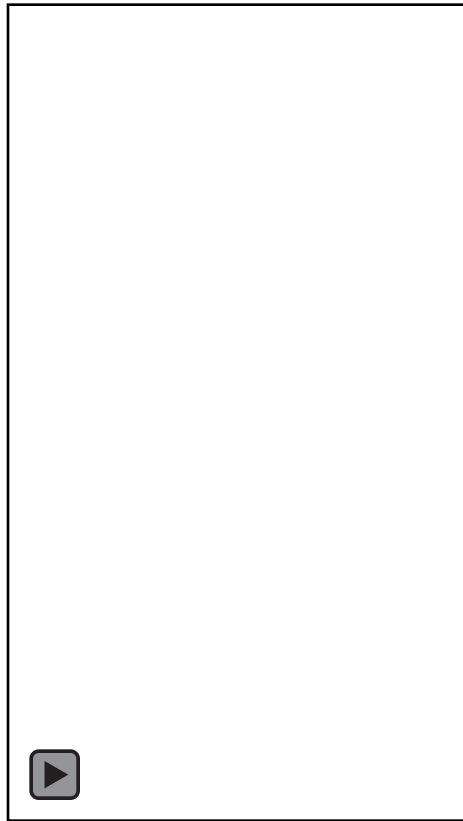
AHU Replacements



AHU Replacements



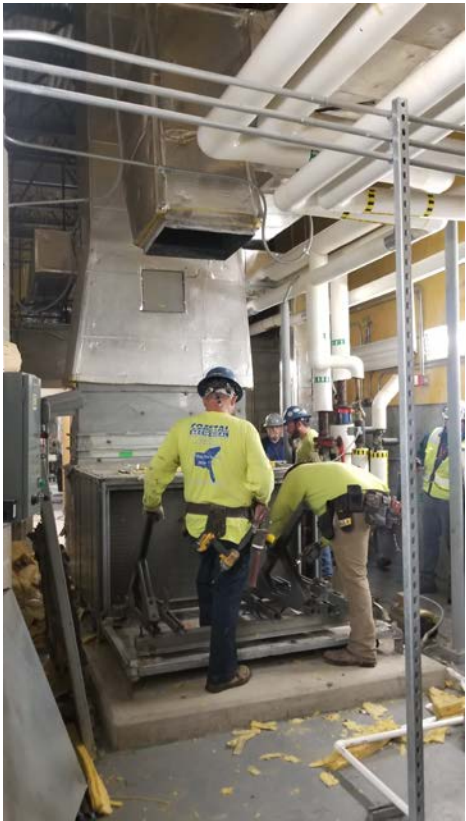
AHU Replacements



AHU Replacements



AHU Replacements



AHU Replacements



Ocoee MS Gym



Image # 33
Date : 05.28.2019
Photo 888.542.0231



Ocoee MS Gym



Image # 83
Date : 08.27.2019
Photo 888.542.0231

AHU Relocation



AHU Relocation



Fan Terminal Box Replacement



Fan Terminal Box Replacement



Exhaust Fan Replacements



Conversion to Chilled Water



Conversion to Chilled Water



Other HVAC Scope



Design Improvements

- No rooftop equipment except exhaust fans
- Air-cooled chillers in lieu of water cooled
- Electric heat, in lieu of boilers and hot water piping
- No limestone or crushed concrete in chiller yards
- Pumps located inside buildings
- Chiller coil coating
- VAV boxes, in lieu of fan terminal boxes
- Bi-polar ionization to reduce outside air requirements
- Direct drive fans (no belts)
- Outside air dampers rated for high humidity
- Updated motor technology to avoid motor burnout

HVAC Lessons Learned

- Scope needs to address all issues unless there is a commitment from OCPS Maintenance to address
- Insure chiller or AHU replacement projects include provisions to flush chilled water lines
- Better coordination is required when replacing Building Automation Systems
- Summer work must be treated as a contract phase, with required substantial completion and liquidated damages

Facilities

Questions and Discussion