



# Advancing Energy Efficiency in State Facilities During the COVID-19 Pandemic

## Commonwealth Energy Management and Control System

Finance and Administration Cabinet - Department for Facilities and Support Services

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## CEMCS History

- **KRS 56.782 – Report consumption, cost, and energy-efficiency measures in state government**
- Current Implemented – 1500+ Buildings, 23.1M ft<sup>2</sup> (\$28M annual spend in FY19)
- A software platform that can handle:
  - Utility Monitoring and Analysis
  - Automated Utility Bill Paying
  - Building Automation Integration and Diagnostics
  - Work Order Generation and Tracking



CEMCS Team

**Better Buildings**  
U.S. DEPARTMENT OF ENERGY

**NASCA**  
National Association of State Chief Administrators

**AEE**  
Association of Energy Engineers

**ENERGY STAR**

**CEMCS**

Andrew Carter  
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Lacey Roberts  
Scott Wood  
Scott Baker

INNOVATION  
NASCA  
AWARDS

Kentucky

## Utilities

- Utility Bill Entry
  - Manual Entry
  - Electronic Data Interchange (EDI)
- Demand Interval Data
  - Utility Meters
  - Submeters

Electric : \$204208.38 Saved to Date

Month	Baseline (\$)	Actual (\$)
Jul 2016	80,000	50,000
Sep 2016	60,000	35,000
Nov 2016	70,000	45,000
Jan 2017	70,000	45,000
Mar 2017	70,000	45,000
May 2017	70,000	45,000

Use per Day vs Mean Daily Temperature

Use per Day vs Date

Kentucky



# Building Automation Systems

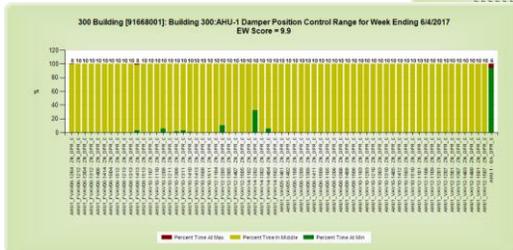
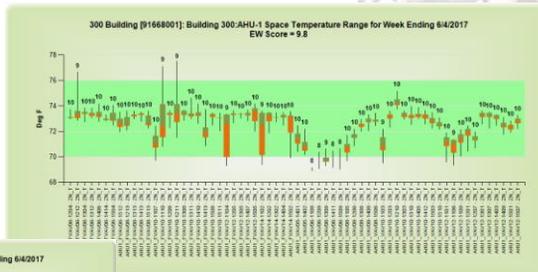
## BAS Monitoring

- Monitoring air quality and how each facility is managed to attain that quality
- How tight is the building and how does the weather affect its operation
- How can we do better with what we have or can we make data based justification for new equipment.



# Building Automation Systems

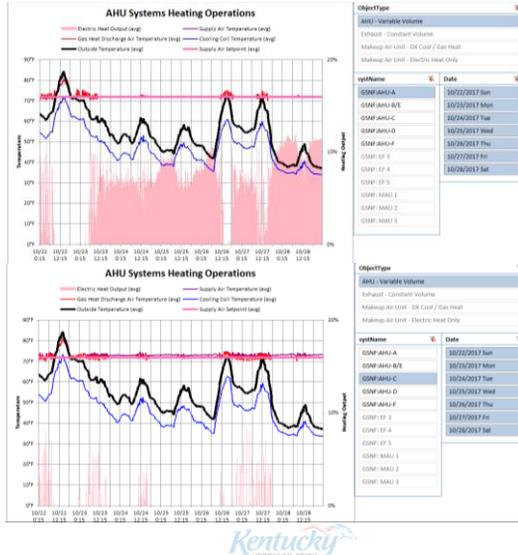
- Comfort Scores
- Run Times
- Damper Positions





# Data Analytics-

- Two units from a building with 4 identical zones

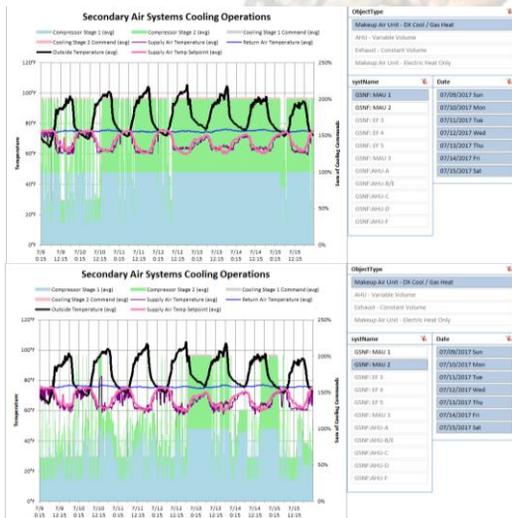


- Nearly identical operation, but notice strip heat.



# Data Analytics-

- MAU 2 is running much more efficiently than MAU 1
- Once these trends were discovered further investigation ensued and it was discovered that the sequence of operation for the staging of the compressors was programmed incorrectly in MAU 1
- Again NO Occupant Complaints or issues so this could go on for years without ever being known if it were not for CEMICS



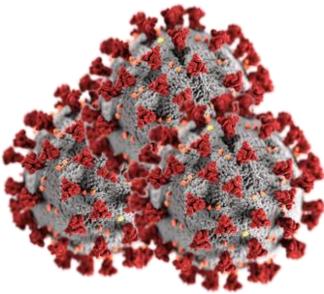


# Our Unique Building Portfolio...



# Healthy at Home

Holistic Building Operations Analysis





## KY – What did we do for SARS-CoV-2?

- First Case in Kentucky – March 6
- Started Healthy at Home – March 19
- Healthy at Work
  - No date announced for state employees, but we expect 30-50% occupancy
  - Those who are able to work from home, continue to do so.
- “When State of Emergency is over, return to work.”



## Healthy at Home

- Many employees shifted from offices to home during the week of March 16.
  - Most, but not all departments worked from home. There were some holdouts.
  - Intermittent employee traffic (mail, people retrieving items from office, using printers, etc.)
    - Offices are not at 0% occupancy (est. <15%)
    - Some local employees chose to stay in the office
- Some agencies had to cancel classes, events, or close altogether so we'll give examples of some of the difference we're seeing for each.





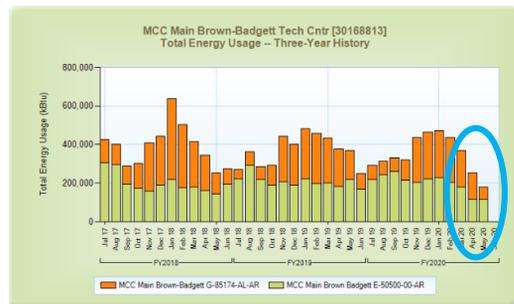
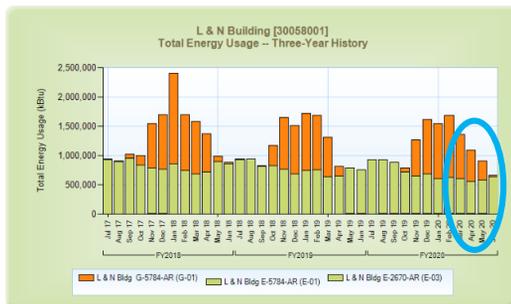
# Low & No Occupancy Building Considerations

- Expectation of inherent savings
  - Reduced people (heat) load
  - Reduced plug load
  - Reduced lighting load in individual offices but not common areas
  - HVAC Operation (DCV)
    - No deep long term setbacks
      - Intermittent traffic and employees wishing to still work in the office
    - Continue to utilize DCV while occupancy is low



# “Unoccupied” vs. Unoccupied

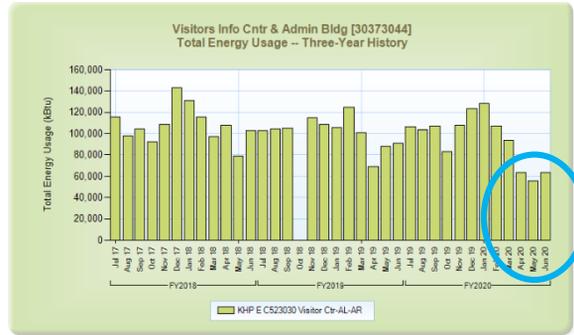
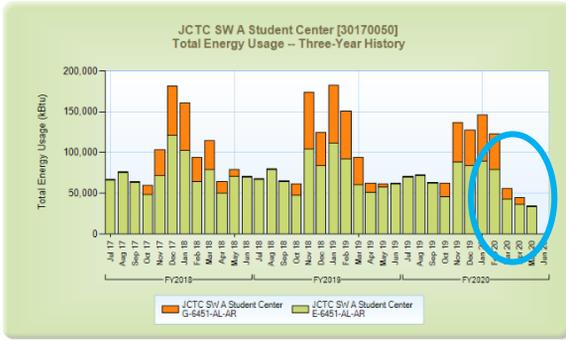
- While Finance buildings are still operating as normally scheduled with <15% occupancy, our community colleges are 100% closed have shown a reduction by setting back temperatures and reducing schedules.



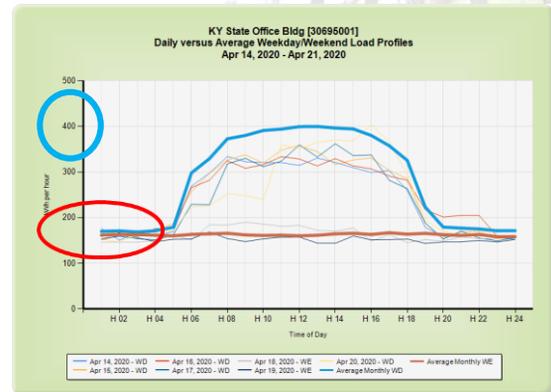
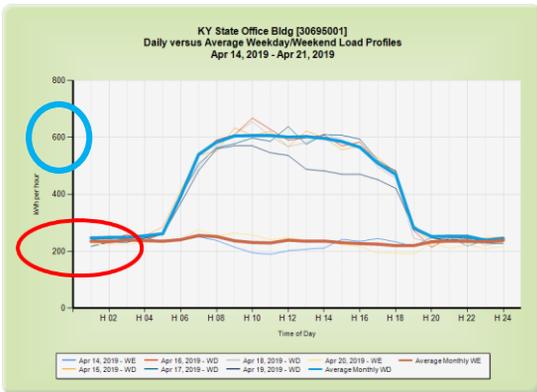


# Ex. Unoccupied Agencies

- KCTCS, KY Horse Park, Fairgrounds



# Occupied vs Unoccupied - KSOB





# Healthy at Work

Planning and Evaluating Buildings for Occupied Operations



## Healthy at Work - Evaluation

- Survey Buildings
  - Types of HVAC Systems
  - Types of Filters from PM Schedule
    - Can we handle increased filtration?
    - Do we have UV germicidal lights?
- Capabilities
  - DCV
  - Economizing
- Schedules

	A	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
	Building Name	HVAC System Type	No. of AHUs	Filter Type	Schedule	OA/Econ	Eath OA Enab	DCV	HEPA filters?	New filters	Clean Dormant Ducts	Exp Hrs of Op	Ppl/Zone	Increase OA	Enthalpy OA	Disable DCV	RI #0-6
6	LIBRARIES & ARCHIVES	DD VAV (AHUs for offices & MZ for Archives)	6		Archive Areas 24/7, Offices 6-10am	VAV Yes, MZ Yes no econ	No [could pull from weather station?]	No	No	Yes	N/A	Yes		Maybe			
7	SPINDLETOP ADMINISTRATION BLDG	CV HW reheat, exhaust (pressure control)	1		7:30am-5pm, 5d/w	Yes			Yes	N/A		Yes		Yes	Yes	Yes	
8	MADISONVILLE SOB	FCUs, 2-pipe			6am-6pm, 6d/w	Fixed			No	No	Yes	N/A	Yes				
9	CAPITOL	FCUs 2-pipe (perimeter), CV (cooling-only interior), CV HW Reheat, Radiant perimeter heat, FP-VAV Boxes (cooling) w/ bypass	10		24/7	Mixed	House/Senate yes	No	No	Yes	N/A	Yes		Yes	Yes		
10	CAPITOL ANNEX	CV HW Reheat, Radiant perimeter heat, FP-VAV Boxes (cooling) w/ bypass	17		24/7	Yes	Yes (1-15)	Yes	No	Yes	N/A	Yes		Yes	Yes	Yes	
11	GOVERNOR'S MANSION	Face Bypass HW & CW	34		24/7	No, FCU GIB/yes		No	No	Yes	N/A	Yes		Yes			
12	GOVERNOR'S GUEST HOUSE	Residential								Yes	N/A						
13	GOVERNOR'S REC BLDG	Residential								Yes	N/A						
14	CAPITOL EDUCATION CENTER	HW VAV box	1	UV	AHU has closed, bathrooms open	Yes		Yes	No	Yes	N/A	Yes		Yes			





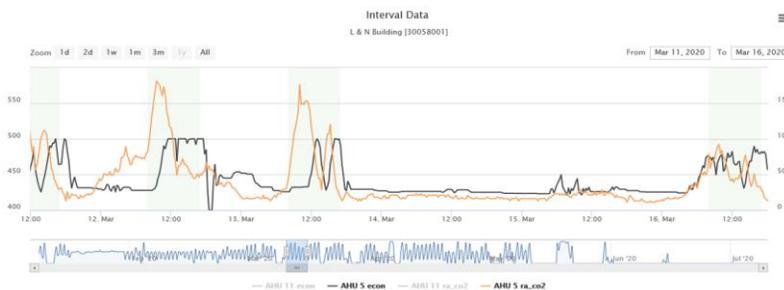
## ASHRAE/AIA/CDC Recommendations

- ASHRAE and AIA have provided general guidelines on steps to take to mitigate the spread of COVID-19 within the workspace.
  - Increase Filtration
  - Expand Occupied Schedules
  - Increase Outside Air Ventilation
    - Disable Demand Control Ventilation
  - Expand Exhaust Fan Schedules
  - Negatively Pressurize the Building and Open Operable Windows



## ASHRAE Energy and Cost Impact

- Schedules
  - Energy Impact – 4.4M MMBtu, \$75,000/yr
- Increase OA, Disable Demand Control Ventilation
  - Energy Impact – 26M MMBtu, \$460,000/yr



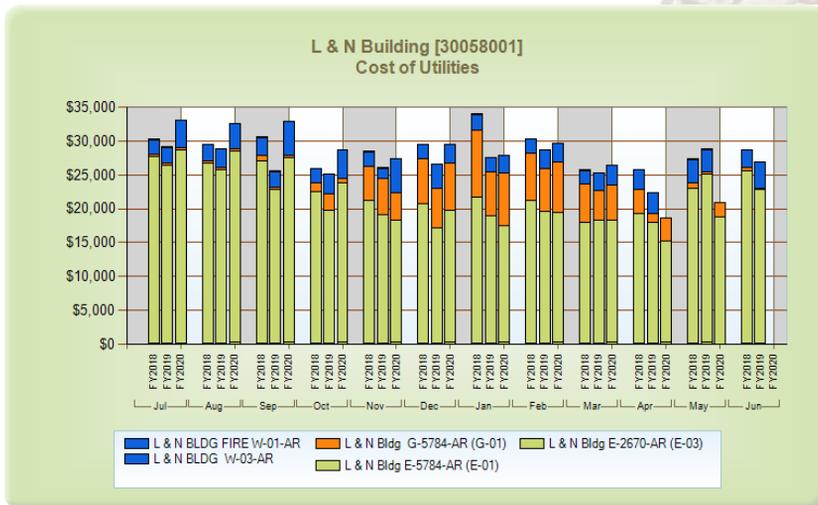


# Monitoring

Tools for Monitoring Operations Before, During, and After Healthy at Home (shutdown)



# Utilities



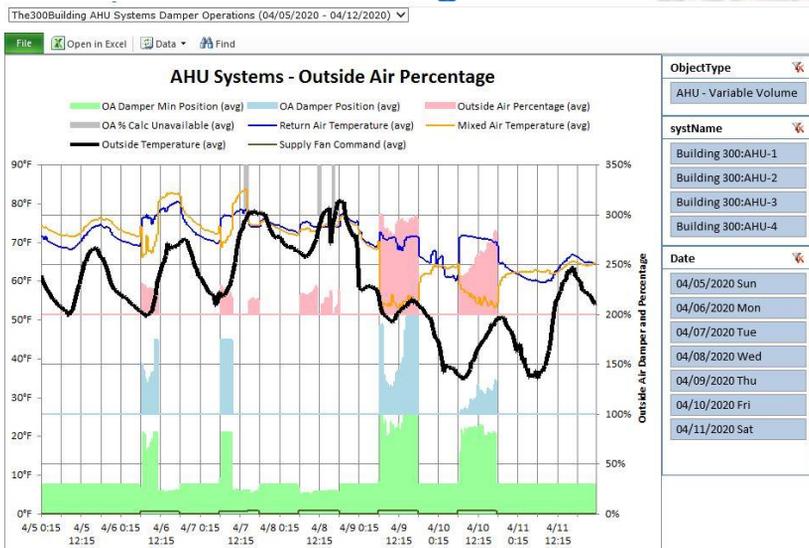


# BAS - Operations

- BAS
  - Schedules
  - Equipment Overrides
  - Logic Disabling
  - Reporting
    - Heating, Cooling, Economizer Modes
    - Damper Positions



# CEMCS – Ventilation Diagnostics





## Resources

- <https://www.ashrae.org/technical-resources/resources>
- <https://www.aia.org/pages/6280670-covid-19-resources-for-architects>
- <https://buildings.lbl.gov/emis/better-buildings-alliance-emis-rd-team>
- <https://www.who.int/emergencies/diseases/novel-coronavirus-2019>
- <https://www.cdc.gov/coronavirus/2019-ncov/index.html>
- <https://coronavirus.jhu.edu/map.html>




Commonwealth Energy Management and Control System

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Welcome To

### Kentucky Energy Savings Dashboard

Welcome to the Commonwealth Energy Management and Control System (CEMCS) public dashboard. This dashboard tracks the progress of energy and cost savings initiatives for buildings throughout Kentucky.

The CEMCS is an innovative software application which is integrated to utility company billing, building automation systems and statewide accounting systems.

The data collected from these sources enables the identification of energy-saving opportunities and verification of corrective actions that reduce energy use, and thus allows the Commonwealth to operate as much as 25% more efficiently in integrated facilities.

Data Engine by:



### Statewide

Utility Savings  
**9.2%**

**On track to meet 2025 goal of 25%**

Current energy consumption compared to historic baseline, normalized for variations in weather.



Annual Utility Cost Savings  
**\$9,550,663**

All utilities (energy + water) compared to historic baseline, weather normalized.



Total Buildings  
**860**

Total Square Footage  
**16,841,286**

Total Occupants  
**26,158**

Total Annual Utility Cost  
**\$31,594,451**

**the State that are using CEMCS to track data.**

[Kyenergydashboard.ky.gov](https://kyenergydashboard.ky.gov)





## Statewide Cost Avoidance

Year	\$ Avoidance
2010	\$382,237
2011	\$457,785
2012	\$1,167,982
2013	\$1,674,386
2014	\$2,203,756
2015	\$2,876,247
2016	\$3,342,815
2017	\$5,126,179
2018	\$5,752,731
2019	\$6,660,672
2020	\$8,192,946
<b>Total</b>	<b>\$37,837,736</b>

**1,385,981,570 kBtu - Or Greenhouse Gas reduction equivalency of:**

169,780



barrels of oil consumed

12,416



homes' electricity use for one year

80,802,117



Pounds of coal burned

181,965,967



Miles driven by an average passenger vehicle



## Thank You

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