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# Managing Buildings During a Shutdown and Bringing Them Back Online

Better Buildings Space Conditioning Technology Research Team at the National Renewable Energy Laboratory

May 1, 2020

2:30 – 3:30 pm EDT

# Agenda

- Introductions
- HVAC Research Team
  - Marcus Bianchi, NREL – Senior Research Engineer
  - Miles Hayes, NREL – Research Engineer
  - Michael Deru - Senior Research Engineer
- Speakers
  - George DuBose, Liberty Building Forensics Group
  - Mead Rusert, Automated Logic
- Discussion



# Better Buildings Virtual Summit 2020



<https://betterbuildingsolutioncenter.energy.gov/summit>

- Series of timely webinars & peer exchanges
- The full schedule can be viewed [here](#)
- Register for individual sessions, meet-ups, and workshops [here](#)
- Registration and all sessions **free**

# HVAC Research Team Updates

## Recent Publications

- Evaluation of High Rotor Pole Switched Reluctance Motors to Control Condenser Fans in a Commercial Refrigeration System
  - <https://www.nrel.gov/docs/fy19osti/72476.pdf>
- Planning for Failure: End-of-Life Strategies for HVAC Systems
  - (ASHRAE Journal, December 2019)
- AWT: GSA Guidance for Cooling Towers
  - <https://www.gsa.gov/governmentwide-initiatives/sustainability/emerging-building-technologies/published-findings/water/awt-gsa-guidance-for-cooling-towers>
- Energy Performance Validation of a Gaseous Air Cleaning Technology for Commercial Buildings
  - <https://www.nrel.gov/docs/fy20osti/74545.pdf>
- Provider and User Perspectives on Automated Fault Detection and Diagnostic Products for Packaged Rooftop Units
  - <https://www.nrel.gov/docs/fy20osti/75461.pdf>
- Testing and Evaluation of a Chemical Free Cooling Tower Water Treatment Technology
  - <https://www.nrel.gov/docs/fy19osti/73911.pdf>

## Looking Ahead

- RTU AFDD data analysis
- Thermal Energy Storage outreach, feedback, & guide
- BAS to GEB, Building automation in grid interactive efficient buildings; outreach, feedback

# HVAC Resource Map



[www.HVACresourcemap.net](http://www.HVACresourcemap.net)

HVAC Home

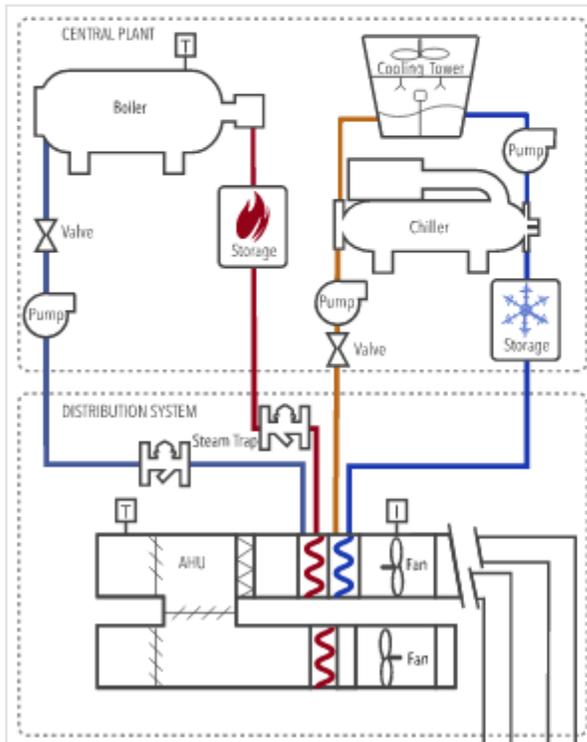
Central Plant

Distribution

Space Loads

Contributors

## HVAC Resources



### What is this resource?

The Central Plant Resource Map is an intuitive graphical interface that provides quick access to a broad array of quality information on operations and maintenance best practices and energy and water efficiency measures. The resources cover the central plant, distribution systems, and zone systems. The primary audiences for this resource are facility managers, operations staff, and design engineers who are looking to improve central plant and distribution efficiency but don't have time to search for these resources.

This Resource Map is not a repetition of guidance provided in codes and standards. It should not be used in lieu of professional engineering services.

### Explore HVAC Resources

Use the horizontal navigation above or the interactive diagram to dive into resources on different HVAC components.

The resources listed on this site have been carefully selected to help narrow your search for helpful information.

# Upcoming Webinar



## MANAGING HVAC SYSTEMS TO REDUCE INFECTIOUS DISEASE TRANSMISSION

Monday, May 4, 2020 2:30 pm to 3:30 pm EST

REGISTER

<https://betterbuildingsolutioncenter.energy.gov/events>

Managing our buildings to minimize the risk of infectious disease transmission is of paramount concern today. Every building and climate are different, making it challenging to have one approach work in all situations. Dr. Bahnfleth will provide a critical review of guidance published by ASHRAE and other built environment organizations and discuss their relationship to recommendations of science and health-focused organizations like WHO. Dr. Bahnfleth will provide expert insight based on the best research for operations to help mitigate risks and what practices to avoid.

**Speaker: Prof. Bill Bahnfleth, Penn State University**



# George DuBose

Liberty Building Forensics Group

# MANAGING BUILDINGS DURING A SHUTDOWN AND BRINGING THEM BACK ONLINE



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**Donald B. Snell**, Senior Forensic  
Mechanical  
**Nate Sanders**, Senior Forensic CIH



# WHO WE ARE

Building Problems

+

Impacting Operations

+

Recovery Costs



# WE CAN LEARN FROM THE PAST

- Closing a Building has Risks
- Watching a Closed Building has Risks
- Re-occupancy must Mitigate Against Risks



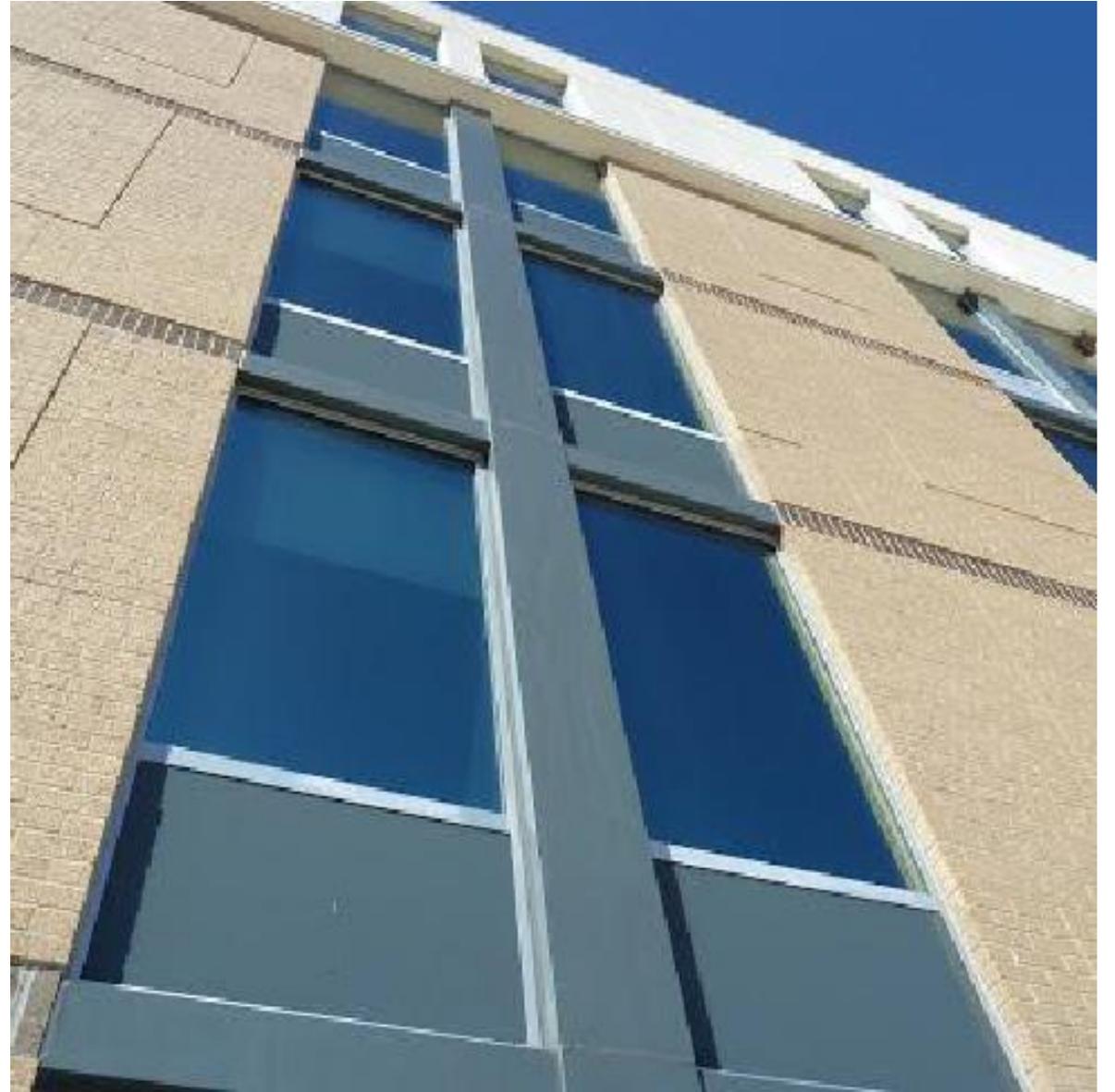
# KNOW HOW TO MITIGATE RISKS OF A CLOSED BUILDING

- Occupants are not present to report issues
- Adapt your systems for a closed building
- Adjust constantly to changes



# CASE STUDY - RESORT GOES FROM 90%+ OCCUPANCY TO SHUTDOWN

- Reduction in Housekeeping
- Reduction in Engineering
- How to handle nearly 1,000 rooms



# KNOW HOW TO MITIGATE AGAINST RISK OF WATCHING A CLOSED BUILDING

- Keep HVAC at or below 60F dp
- Reduce exhaust but keep @ +5pa
- Enhanced walkthroughs
- Occupant screening

# CASE STUDY - SCHOOL

(BUT ALSO APPLIES TO OTHER BUILDINGS)

- Track dp
- Reduce exhaust
- Enhanced walkthroughs
- Employee burden
- Employer burden



# Know How to Mitigate Against Risk When Reopening a Building

- MEP Systems
- Envelope
- Product Expiration
- Cleaning & Disinfection
- Occupant Trust



# Will Occupants Trust Your Building is Safe

- Safety vs. Feeling Safe
- Keep Trust
- Rebuilding Trust



# Case Study - Public Building Evacuated

- Progression of the problem
- Growth of costs
- Finally, resignation



# CLOSING REMARKS

- Past Closures Help Us Now
- Your Asset Remains Active during shut down
- Reoccupancy is both a technical and a trust process

# THANK YOU

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Mead Rusert

Automated Logic



**WE MAKE  
BUILDINGS  
BETTER.**

**MANAGING BUILDINGS  
DURING A SHUTDOWN  
AND BRINGING THEM  
BACK ONLINE**

**Presented by:**  
Mead Rusert  
President  
Automated Logic



# WHO WE ARE

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**Building Automation &  
IoT Solutions**

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Automated  
Logic

**EC**ENERGY  
INSIGHTS

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Automated  
Logic

**Mead Rusert  
President, Automated Logic**

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# A RAPIDLY EVOLVING CRISIS

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## Many retailers have closed operations

*“More than 90 major retailers temporarily closed stores...”*

Business Insider, March 23, 2020

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## Many retailers are running – with new constraints

- Reduced operating hours
  - Reduced staff
  - Curb side delivery
  - Social distancing norm / Safe store environment
- 

## Analyst view

*“A new survey of 98 US-based retail executives in a variety of subsectors finds that most executives expect store traffic to return to pre-crisis levels, but not for at least several months after stores reopen.”*

McKinsey, How retailers are preparing for the post-coronavirus recovery, April 2020

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# NAVIGATING THIS ENVIRONMENT

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New operating paradigm, often conflicting objectives

## Build Trust

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- Employees and customers need to feel safe in the built environment.
- HVAC actions should be in line with best practices and guidelines from ASHRAE and other professional organizations

## Manage Uncertainty

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- Changing needs based on situations at different cities, different building types, and emerging business models.
- This impacts operating parameters - hours, schedules, temp and humidity policies, etc.

## Need for Agility

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- Need for speed
- Deal with limited on site staff availability and limited service resources
- Manage energy and maintenance cost reduction in line with reduced business operations

# RAPIDLY EVOLVING GUIDELINES

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## ASHRAE Statement

ASHRAE officially opposes the advice not to run residential or commercial HVAC systems and asserts that keeping air conditioners running during this time can help control the spread of the virus.

On airborne transmission of SARS-CoV-2/COVID-19: *Transmission of SARS-CoV-2 through the air is sufficiently likely that airborne exposure to the virus should be controlled. Changes to building operations, including the operation of heating, ventilating, and air-conditioning systems, can reduce airborne exposures.*

On operation of heating, ventilating, and air conditioning systems to reduce SARS-CoV-2/COVID-19 transmission: *Ventilation and filtration provided by heating, ventilating, and air-conditioning systems can reduce the airborne concentration of SARS-CoV-2 and thus the risk of transmission through the air. Unconditioned spaces can cause thermal stress to people that may be directly life threatening and that may also lower resistance to infection. In general, disabling of heating, ventilating, and air-conditioning systems is not a recommended measure to reduce the transmission of the virus.*

**Many industry resources now available**

## Eurovent Guideline, April 10

- Increase ventilation rates and increase the percentage of outdoor air in the system
- Extend the operating time of the ventilation system
- Check that the ventilation units are properly set up and they are serviced correctly in accordance with the manufacturer's instructions
- Consider maintaining the indoor relative humidity above 30% (where possible)

**You need to work within your system constraints**

# CRITICAL SUCCESS FACTORS

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**Industry  
Best Practices**



**Quality  
Assurance**



**Standard Operating  
Procedures**



**Data centric monitoring  
and analysis**



**Remote, connected services enable speed at scale**

# EXAMPLES: MULTI-SITE RETAIL

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## Big Box Retail #1

- Hours reduced, but vary by location

## Big Box Retail #2

- Shift to curbside delivery only. ~40% of stores closed.

## Department store chain

- All stores temporarily closed

## Quick serve restaurant chain

- Drive thru only. Dine-in closed

Wide range of BMS and HVAC system vintages, suppliers and capability within customers

- Changes implemented quickly with with new changes ongoing
- Closed stores: >50% energy reduction in one 50 site sample
- Reduced hours stores: 5-6% energy reduction

# PREPARING FOR THE NEXT PHASE: RE-START

## Purge

Clear the air inside the confined spaces with fresh air

1. Enable all the exhaust & supply fans.
2. Run air handling units
3. Identify systems which are not working as intended
4. Mind humidity and climate constraints



## Check Health Cyclically

Test run the assets for normal occupied operating conditions and monitor faults

1. Create logical groups of equipment
2. Identify faults such as communication loss, faulty sensors, failed dampers, etc
3. Schedule maintenance or shutdown of these assets until they can be fixed.



## Prepare for Start up

Update policies

1. Update operating policies (ventilation, humidity, etc)
2. Standardize operating hours
3. Update control programs
4. Prioritize list of systems that need service dispatch



## Operate

Perform quality checks to ensure readiness

1. Implement batch programs and schedule changes to be tested
2. Remotely fix issues where possible
3. Continuous ventilation day prior to the start of operations – per your policies

# FOR MORE INFORMATION

## Helpful References:

- ASHRAE EPIDEMIC TASK FORCE Healthcare Guidance | Updated 4-20-2020
- Recovering from COVID-19 Building Closures Guidance Document, AIHA - American Industrial Hygiene Association
- ASHRAE Position Document on Airborne Infectious Diseases, 2014
- ANSI/ASHRAE STD. 62.1/62.2-2019
- ASHRAE 90.1

## Contacts and Websites:

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www.ecoenergyinsights.com **ECOENERGY** Insights

### STARTING UP RETAIL STORES POST COVID-19 SHUTDOWNS

Deploying industry best practices helps ensure reliable operations

In the wake of the COVID-19 crisis, retail stores are facing unique challenges. These challenges include interrupted operations, air quality issues, and limited usage and/or missed preventative maintenance of HVAC equipment due to unoccupied facilities. As the summer approaches, retail facilities will want to ensure reliable operations. As such, the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), along with other industry organizations, have suggested best practices for operating in the time of the COVID-19 pandemic and beyond.

The recommendations include:

-  Ensuring high ventilation rates
-  Operating HVAC equipment continuously during building occupancy
-  Using high efficiency filters
-  Limiting the dew point to 60°F to minimize wet surfaces

**EcoEnergy Insights Safe Start Program**  
The EcoEnergy Safe Start program translates these best practice recommendations into specific actions and then deploys them, helping to ensure smooth store operations as well as employee and customer safety, when you are ready to reopen your retail stores.

-  **Healthy Occupants**  
We increase ventilation to help ensure employees, customers, and cleaning/maintenance staff stay healthy.
-  **Healthy Equipment**  
We help ensure your HVAC equipment is operating properly.
-  **Healthy Systems**  
We review control strategies to ensure systems are operating optimally.
-  **Easy launch of the program**  
We launch the program in three easy steps, with almost all actions carried out remotely.

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<https://ecoenergyinsights.com/>



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BETTER.**

**THANK YOU**

Mead Rusert  
President  
Automated Logic



# Q&A

# Additional Questions?

Please Contact Us



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# Thank You!



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