



# **SB 2030 EDUCATION SESSION**

**Beyond Cutsheets and Keys: Best  
Practices in Building Handoff**



# **BEYOND CUTSHEETS AND KEYS: BEST PRACTICES IN BUILDING HANDOFF**

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## **Presenters:**

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**Mechanical Engineer, Center for Energy and Environment**



# AGENDA

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- **THE GOAL: ENERGY EFFICIENCY +**
- **SB 2030 SOFTWARE TOOL FOR ENERGY EFFICIENT OPERATION**
- **BUILDING COMMISSIONING**
- **REQUIRED PROJECT DELIVERABLES**
- **COMMON DEFICIENCIES IN DELIVERABLES**
- **AN IDEAL PROCESS FOR BUILDING HANDOFF**



# THE GOAL

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1. PROVIDE A SAFE ENVIRONMENT
2. MAINTAIN A COMFORTABLE ENVIRONMENT
3. AVOID PREMATURE EQUIPMENT FAILURE
4. MAINTAIN EQUIPMENT CAPACITY
5. MAINTAIN ENERGY-EFFICIENT OPERATION



# ENERGY EFFICIENT OPERATION

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THE GOAL OF ENERGY EFFICIENT OPERATION IS

**“To ensure that each significant energy-consuming device uses only as much energy as necessary to perform its intended function.”**

**-Peter Herzog, Author:**

*Energy-Efficient Operation of Commercial Buildings: Redefining the Energy Manager's Job*



# ENERGY EFFICIENT OPERATION

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## TAKEAWAY FROM THE FIELD:

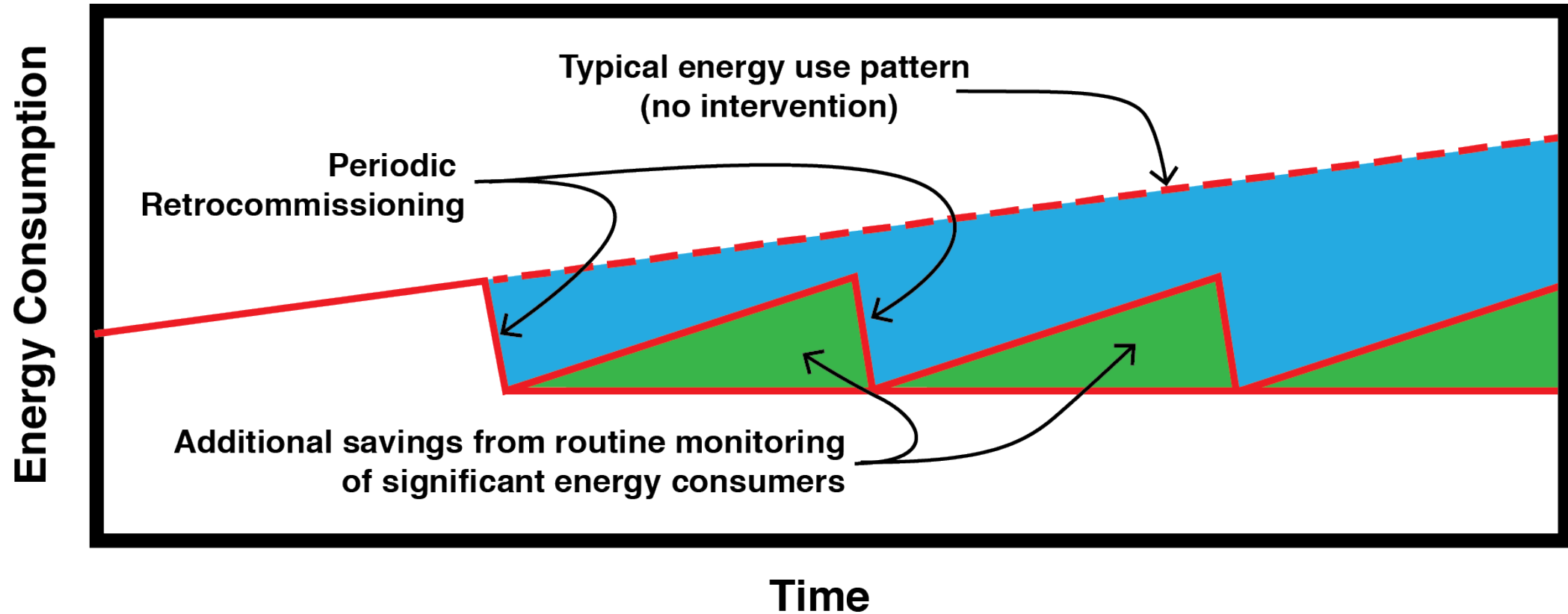
**Building operators are doing a great job at keeping occupants comfortable and protecting system components.**

**However, buildings that are not routinely checking for unannounced energy waste are using 10 to 35 percent more energy than they need to.**



# ENERGY EFFICIENT OPERATION

How does this happen?





# ENERGY EFFICIENT OPERATION

What does a malfunction look like?

For both examples:

OAT = 50F

RAT = 75F

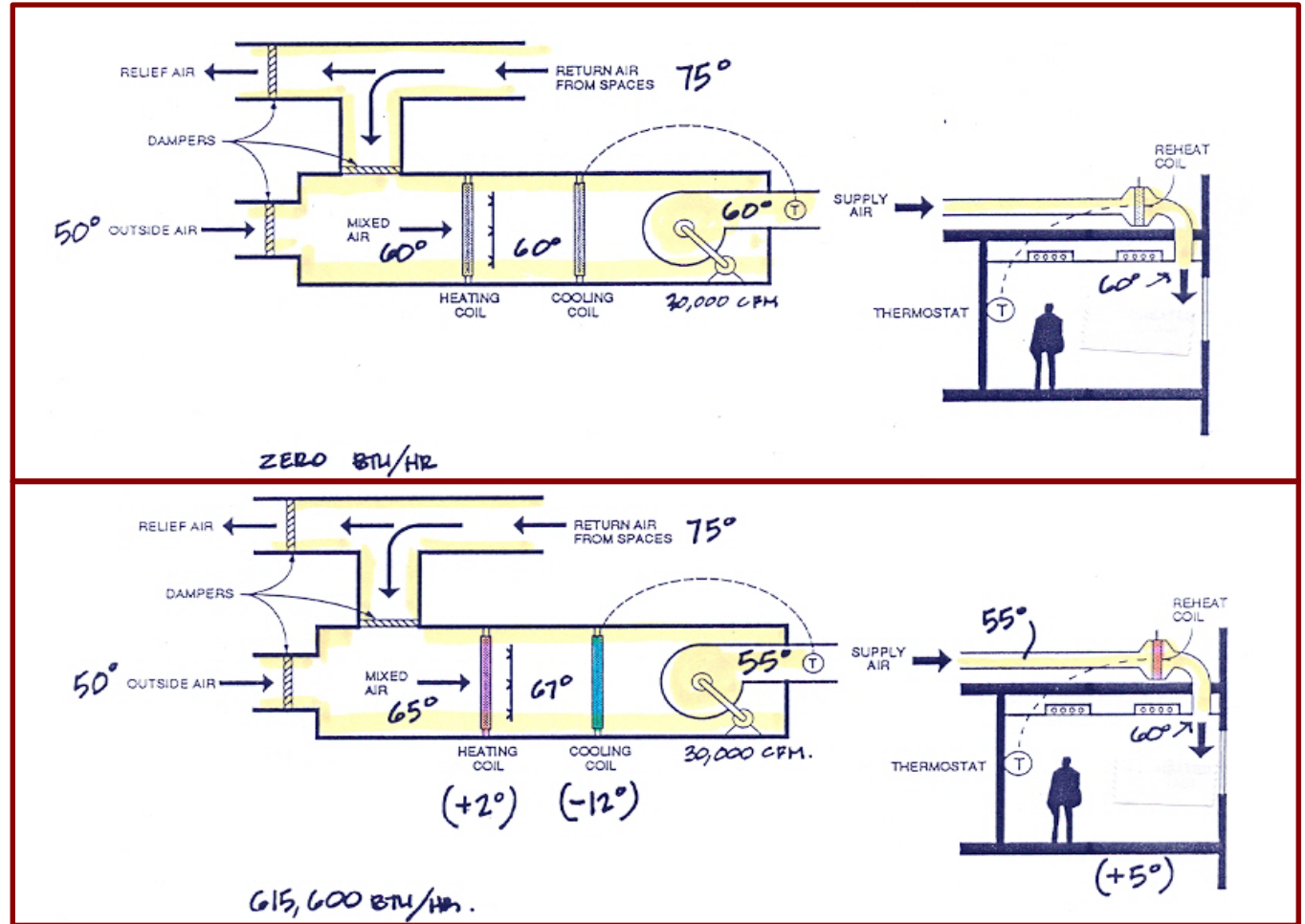
SAT = 60F

30,000 CFM supply airflow

And...

**OCCUPANTS HAVE NO COMPLAINTS!**

*Cartoon courtesy of Peter Herzog*





# SB 2030 ENERGY EFFICIENT OPERATIONS PROGRAM

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## OUR APPROACH:

The goal is to ensure that each significant energy-consuming device uses only as much energy as necessary to perform its intended function.

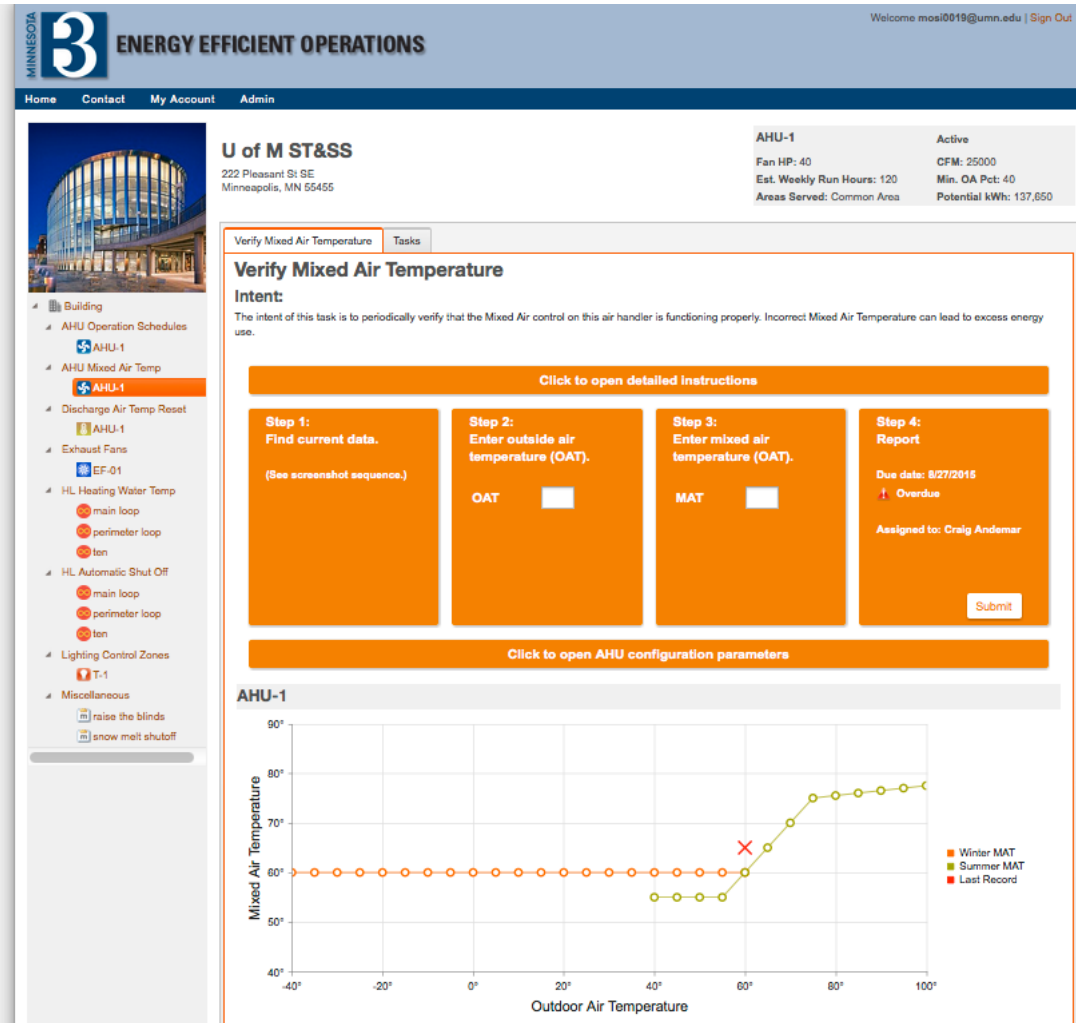
This is done by following a customized protocol composed of well-defined tasks performed on a routine basis.

These tasks :

- Are as simple as needed to accommodate staff skill level
- Occur as infrequently as possible
- Are targeted to identify significant energy waste that would not otherwise be noticed by occupants or operators



# SB 2030 ENERGY EFFICIENT OPERATIONS PROGRAM



## Our Tool:

- Is a web-based software application.
- Is set up by a knowledgeable agent.
- Is composed of as few a number of tasks, performed as infrequently as possible to identify the majority of energy waste potential.
- Sends automated email alerts when tasks are due, and includes detailed instructions on how to complete the task.
- Reports to facilities manager by email when malfunctions are discovered.
- Includes a “dashboard” view of all tasks for review by the facilities manager.



# SB 2030 ENERGY EFFICIENT OPERATIONS PROGRAM

The screenshot shows the 'U of M ST&SS' Energy Efficient Operations web application. The header includes the Minnesota State logo and navigation links: Home, Contact, My Account, Admin. A sidebar on the left lists various building systems like AHU Operation Schedules, Mixed Air Temp, Discharge Air Temp Reset, Exhaust Fans, Heating Water Temp, Automatic Shut Off, Lighting Control Zones, and Miscellaneous. The main content area is titled 'Negotiate Shortest Possible Schedules' and includes a table for AHU-1 with details like Fan HP, Run Hours, and Potential kWh. Below this, a 'Click to open detailed instructions' button leads to a four-step process: 1. Review area served, 2. Contact negotiation participants, 3. Record changes, and 4. Report. A 'Submit' button is at the bottom of the steps.

MINNESOTA **3** ENERGY EFFICIENT OPERATIONS

Welcome mos0019@umn.edu | Sign Out

Home Contact My Account Admin

**U of M ST&SS**  
222 Pleasant St SE  
Minneapolis, MN 55455

AHU-1	Active
Fan HP: 40	CFM: 25000
Est. Weekly Run Hours: 120	Min. OA Pct: 40
Areas Served: Common Area	Potential kWh: 137,650

Negotiate Shortest Possible Schedules Verify Schedules In The Timer Verify Timer Operation Tasks

### Negotiate Shortest Possible Schedules

**Intent:**  
The intent of this task is to periodically verify that the operating schedule represents the latest possible morning start times and the earliest possible afternoon or evening stop time required to serve the needs of the people who currently occupy the areas served.

**Click to open detailed instructions**

**Step 1:**  
Review area served by this AHU.  
(See zone map.)

**Step 2:**  
Contact negotiation participants and ask key questions.

**Step 3:**  
Record changes to schedule.

**Step 4:**  
Report  
Due date: 4/27/2016  
Overdue  
Assigned to: Craig Andemar  
Previous schedule annual runtime: 0  
New schedule annual runtime: 0  
Submit

**Key questions to negotiate:**

- What range of temperature and humidity have occupants agreed is acceptable?
- At what time in the morning should conditions be within that range?
- How long does it take the AHU to achieve these conditions for each day of the week and season of the year?
- What is the latest possible morning start time for each day of the week (including weekends)?
- At what time in the afternoon or evening can temperature and/or humidity go out of occupant acceptable range?
- How long after shutdown does it take for conditions to go out of range?
- Are operating hours extended to accommodate custodial activities, and if so, can these hours be reduced or eliminated?

## Our Tool Is Not:

- A substitute for Commissioning or Retrocommissioning. The setup process requires a building that has identified and documented correct energy efficient operations parameters.
- Focused on capital improvements. It is instead focused on ensuring that whatever equipment is present is operated in an energy efficient manner.



# NEW BUILDING COMMISSIONING

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## WHY IS COMMISSIONING NEEDED?

- **COMMON BUILDING ISSUES WITHOUT COMMISSIONING**
  - Design Deficiencies
  - Missing Equipment
  - Incorrect Installation of Equipment or Assemblies
  - Lack of Temperature Control and Occupancy Space Comfort
  - Building Doesn't Operate as Owner Originally Intended
    - Lack of knowledge on how building is designed to operate



# NEW BUILDING COMMISSIONING

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## WHAT IS NEW BUILDING COMMISSIONING?

- A quality focused process for enhancing the delivery of a project and performance of the systems in the building. Focuses on verifying and documenting that all systems to be commissioned are designed, planned, installed, and tested to meet the requirements of the building owner.

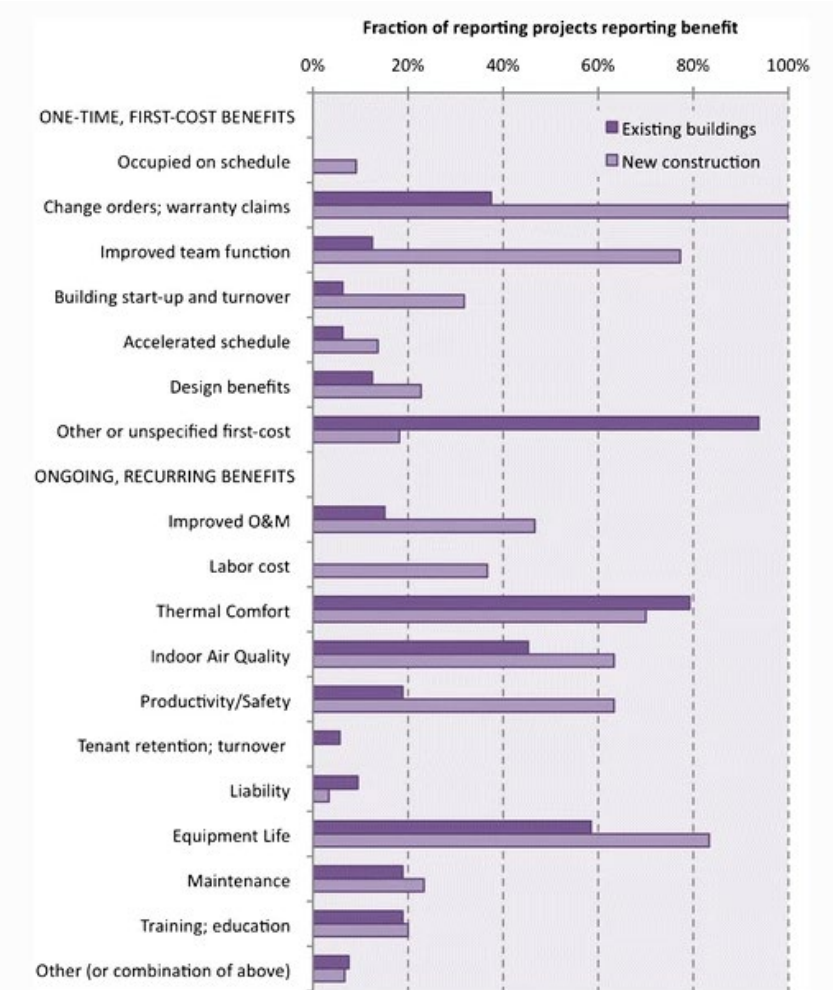




# NEW BUILDING COMMISSIONING

## COMMISSIONING BENEFITS

- Fewer change orders
- Lower overall project costs
- Building operates as owner intended
- Improved operator knowledge of building operation
  - Complete building documentation

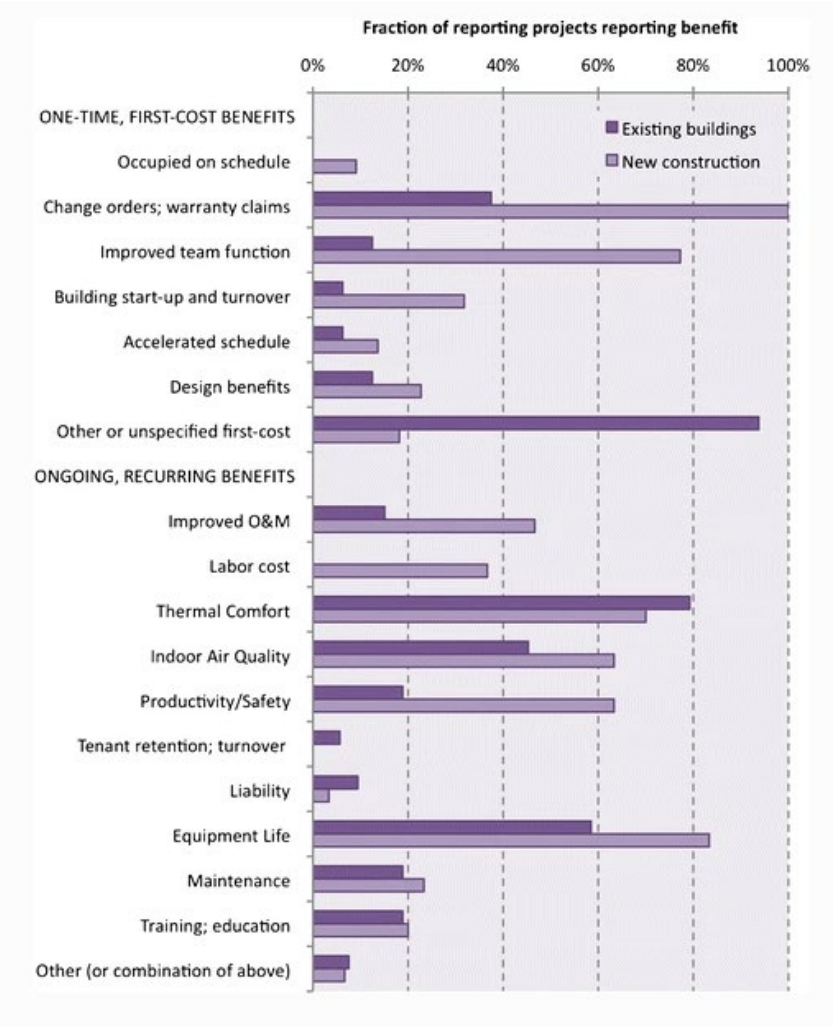




# NEW BUILDING COMMISSIONING

## COMMISSIONING BENEFITS

- Improved IAQ
- Improved occupant thermal comfort
- Increased occupant productivity
- Energy savings

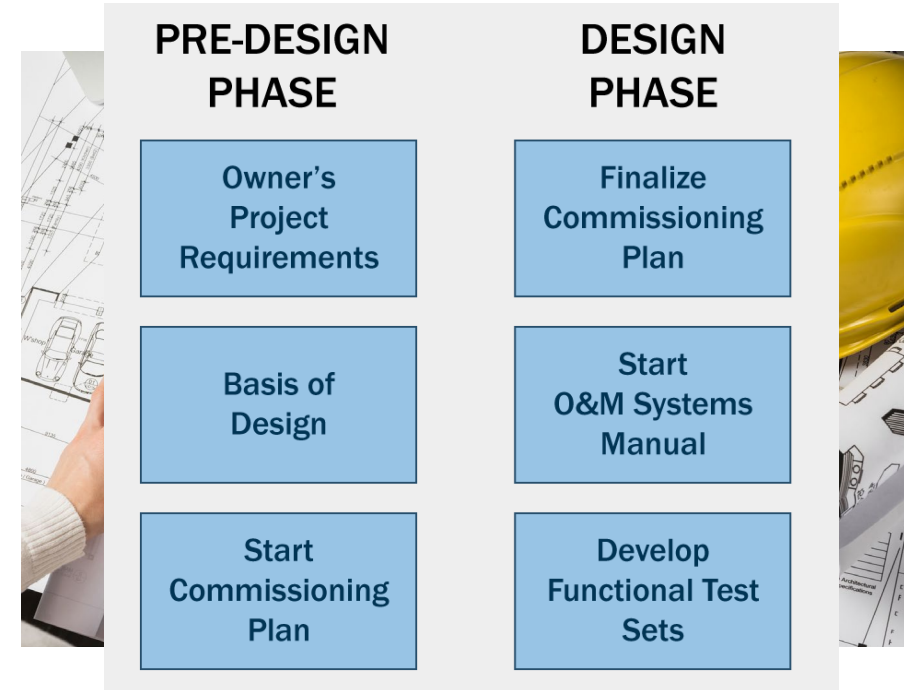




# EFFICIENT CX DOCUMENTATION

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1. CONSTRUCTION DOCUMENTS
2. OWNERS PROJECT REQUIREMENTS (OPR)
3. BASIS OF DESIGN (BOD)
4. EQUIPMENT INSTALLATION CHECKLISTS





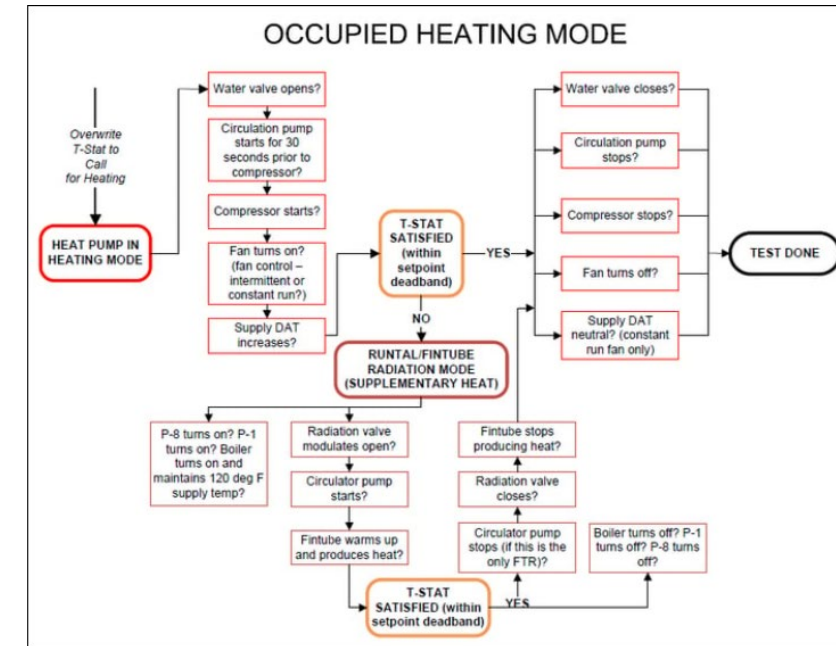
# EFFICIENT CX DOCUMENTATION

## 5. FUNCTIONAL PERFORMANCE TEST RESULTS

## 6. ISSUES LOG

## 7. TRAINING DOCUMENTATION

## 8. MAINTENANCE PROGRAM DOCUMENTATION





# **EFFICIENT CX DOCUMENTATION**

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**9. FINAL COMMISSIONING REPORT**

**10. SYSTEMS MANUAL**



# BUILDING DOCUMENTATION DEFICIENCIES

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- **INCOMPLETE SEQUENCE OF OPERATIONS**
  - Sequences sometimes change as the project progresses or they lack detail initially
- **LACK OF VERIFICATION DOCUMENTATION**
  - TAB, point-to-point, site assessments, equipment installation checklists
- **LACK OF COMMISSIONING TEST RESULTS**
- **NO FINAL COMMISSIONING REPORT**





# EFFICIENT COMMISSIONING GUIDELINES

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- **COMMISSIONING AGENT INVOLVED AT PRE-DESIGN PHASE**
  - Develop and continuously update BoD and OPR
  - Coordinate plan review workshops
  - Confirm and document training requirements during design phase
- **BEGIN DEVELOPING FINAL COMMISSIONING REPORT DURING DESIGN PHASE**
- **COORDINATE COMMISSIONING KICK OFF MEETING**



# EFFICIENT COMMISSIONING GUIDELINES

- **ISSUE LOGS ARE MAINTAINED DURING ALL PHASES OF PROJECT**
- **SEQUENCE OF OPERATIONS ARE UPDATED WITH FINAL, AS-DESIGNED SEQUENCES**
- **OTHER RECOMMENDATIONS CAN BE FOUND IN ASHRAE GUIDELINE 0**



**ASHRAE Guideline 0-2019**  
(Supersedes ASHRAE Guideline 0-2013)  
Includes ASHRAE addenda listed in Appendix Q

## The Commissioning Process

See Informative Appendix Q for ASHRAE approval dates.

This Guideline is under continuous maintenance by a Standing Guideline Project Committee (SGPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the Guideline. Instructions for how to submit a change can be found on the ASHRAE® website (<https://www.ashrae.org/continuous-maintenance>).

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# **SB 2030 ENERGY EFFICIENT OPERATIONS PROGRAM**

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## **QUESTIONS?**

**Contact Garrett Mosiman**  
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