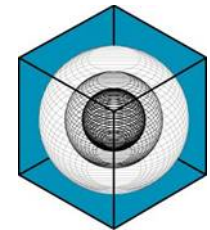


The Role of Existing Building Commissioning and Pitfalls in Selecting Commissioning Measures

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Outline

- Building Commissioning After the Big Earthquake
- A Key Pitfall in Treating Commissioning like the Retrofit Process
- Conclusions



Normal Role of Building Commissioning

- **New Buildings**
 - Bring operational perspective to design process
 - Ensure building operates according to design intent
- **Existing Buildings**
 - Optimize operation of building HVAC systems
 - Save energy cost
 - Improve comfort
 - Improve skills of operating staff



Role of Building Commissioning After the Big Earthquake

- Bring operational perspective to redesign process
- Optimize repair/replacement choices
- Ensure replaced components/sections operate according to design intent
- Optimize operation of remaining and replaced HVAC systems
- Save energy cost
- Restore/Improve comfort
- Improve skills of operating staff



Role of Building Commissioning After the Big Earthquake

- **Building destroyed or heavily damaged**
 - Bring operational perspective to redesign process
 - Optimize replacement choices
 - Ensure replaced systems operate according to design intent



Role of Building Commissioning After the Big Earthquake

- **Building moderately damaged**
 - Optimize repair/replacement choices
 - Ensure replaced components/sections operate according to design intent
 - Optimize operation of remaining and replaced HVAC systems
 - Save energy cost
 - Restore/Improve comfort
 - Improve skills of operating staff



Role of Building Commissioning After the Big Earthquake

- **Building undamaged/lightly damaged**
 - Optimize operation of remaining and replaced HVAC systems
 - Optimize repair/replacement choices
 - Save energy cost
 - Restore/Improve comfort
 - Improve skills of operating staff



Basic EBCx Process Steps

- Planning
- Assessment
- Investigation
- Implementation
- Hand-off
- Ongoing Commissioning

Key Differences Between Retrofit and EBCx Processes

- The retrofit process –
 - Walk-through audit (measure-specific cost/payback, preliminary measure selection)
 - Utility grade audit (detailed measure-specific cost/payback)
 - Design
 - Implementation
- The EBCx process
 - EBCx “assessment” (no measure-specific cost/payback)
 - Detailed measurements and investigation of specific measures focusing on implementation details while preparing implementation plan
- Some customers wish to make measure selection after the EBCx assessment. Unwise since
- Significant EBCx measures often identified or modified after EBCx assessment

A Key Pitfall in Treating EBCx Like a Retrofit

- The retrofit process – Audit provides **measure-specific cost/payback**
- The EBCx assessment doesn't provide **measure-specific cost/payback**
- Some customers wish to make measure selection after the EBCx assessment – unwise since
- **PITFALL: Significant EBCx measures often identified or modified after EBCx assessment**

Example # 1: Large Computing Facility in Texas

- Assessment
 - Reduce excessive Outside Air
 - Minimum steam consumption 230 kg/hr ($\sim 150 \text{ kW}_{\text{th}}$) – cause unidentified
- Detailed investigation found
 - Outside Air normal – no savings
 - Minimum steam consumption due to faulty Pressure Reducing Valve
- Pressure Reducing Valve Repair - \$40,000/yr ($\sim 20\%$ savings increase)
 - Local boilers installed saving another \$100,000/yr
 - Steam line analysis in adjacent site - \$250,000/yr savings
- Steam savings **much** larger than expected Outside Air savings

Example # 2: Large Medical Research Facility: Modify Measure During the EBCx Process

- Initial assessment revealed air-to-air heat exchangers on 100% Outside Air units not used - maintenance issues
- Maintenance improved bypass damper operation, but dampers still didn't operate properly due to poor design.
 - Recommended to leave dampers permanently open.
- This measure increased energy savings by at least 40%



Example # 3: Medical Facility #1

- Initial assessment phase
 - Identified opportunity to optimize operation of two chilled water loops (critical services loop and non-critical services loop)
- Detailed investigation phase
 - Loop opportunity more limited than anticipated
 - Found opportunity to reduce boiler pressure and modify standby operation
- Increased project savings by ~10%

Example # 4: Medical Facility #2

- Several AHUs with VFDs operated at 57 Hz with many zone reheat valves 100% open in summer
- Detailed investigation revealed adequate OA supplied at a fan speed of 30 Hz
- AHUs were placed on VFD operation with speed varied from 30 Hz to 57 Hz based on reheat valve position
- EBCx savings increased by approximately 15%

Example # 5: Airport Terminal Building

- Static pressure reset implemented
- After implementation, both supply and return fans observed to run at minimum speed during low occupancy
- Return fan cutoff point created to shut off return fan when supply fan speed below a certain level
- Thousands of dollars saved, but only 2%-3% of total project savings (>\$1,000,000)

Example # 6: Community College

- Assessment identified measures to
 - Improve chiller operations
 - Optimize the Heating Hot Water system
 - Implement Chilled Water supply temperature reset
- Unable to implement Chilled Water reset because minor controls upgrade not implemented
- Detailed investigation found opportunities to
 - Utilize 1.5 MW boiler as primary with 4.9 MW boiler as backup, and
 - Use 11 kW Heating Hot Water pump instead of 37 kW
- Overall project savings increased by 25% - 40% due to these measures

Example # 7: University Central Plant: Condenser Water Pump

- Initial assessment found
 - Condenser water flow through one cooling tower too low => larger pump needed
- Detailed investigation revealed
 - Condenser water flow through chiller #1 insufficient and differences in requirements between chiller #1 and chiller #2
- Manual valve used to
 - Balance flow
 - Ensure adequate condenser water flow to both chillers
- Avoided cost of purchasing larger pump plus small energy savings

Example # 8: Semi-Conductor Processing Facility

- Assessment phase –
 - “Minor” re-piping needed to implement reset schedules and utilize heat exchanger
- Investigation phase –
 - Re-piping cost higher than client willing to pay
 - Major opportunity - increase boiler loading by reducing operating boilers by one
- Increased boiler loading increased EBCx project savings by ~25%

Summary

Example	Increase in Project Savings
Computing Facility	20%
Medical Research Facility	40%
Medical Facility #1	10%
Medical Facility #2	15%
Airport Terminal Building	2% - 3%
Community College	25% - 40%
Central Plant Condenser Pump	2%- 3%
Semi-Conductor Facility	25%
Average Savings Increase	~18%



Pitfall Summary

- 8 EBCx projects had savings increased by an average of ~18%, with a maximum of nearly 40%, due to implementation of measures not originally identified.
- Significant benefit can result from allowing **thorough investigation** during EBCx **in addition to initial assessment.**

Conclusions

- Commissioning after Big Earthquake will combine elements of Cx and EBCx
- When significant EBCx elements present, be sure to apply EBCx thinking – not retrofit thinking to assessment/investigation process –
- **Conduct thorough investigation during EBCx in addition to initial assessment.**

Thanks





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