

STATE AGENCY ENERGY ADVISORY GROUP (SAEAG)

COMMITTEE MEETING - JULY 18, 2012

Austin, Texas

COMMISSIONING (Cx)

Presented by:

Saleem Khan, MS, P.E., CxA



TEXAS
ENERGY
ENGINEERING
SERVICES, INC.

(TEESI)

1301 S. Capital of Texas Hwy., Suite B-325
Austin, TX 78746
(512) 328-2533



Texas Energy Engineering Services, Inc. (www.teesi.com)



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Outline

- ***Commissioning (Cx) Definition & Purpose***
- ***Cx Applications***
- ***Why Commissioning?***
- ***Commissioning (Cx) – Objectives & Benefits***
- ***Commissioning Provider & Certifications***
- ***Commissioning (Cx) – Misconceptions***
- ***Typical Commissioned Systems***
- ***Types of Commissioning (Cx) Services***
- ***Cx Implementation Monitoring Examples***
- ***Cx Process Selection Consideration***
- ***Costs of Commissioning***
- ***Useful Resources***
- ***Discussion and/or Questions***

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Commissioning (Cx) Definition and Purpose

➤ **Definition**

- In general, commissioning is the process of ensuring that a building performs according to its design intent and the needs of its owners and occupants. (Anderson 1997)
- The Commissioning Process is a quality-oriented process for achieving, verifying, and documenting that the performance of facilities, systems, and assemblies meets defined objectives and criteria. (ASHRAE Guideline 0)

➤ **Purpose**

- The basic purpose of building commissioning is to provide a quality based process with documented confirmation that building systems are planned, designed, installed, tested, operated and maintained in compliance with the **Owner's Project Requirements (OPR)**. (BCA - Building Commissioning Association)

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Cx Applications

- **New Construction**
 - Ground up construction project(s)
- **Additions, Renovations and/or Retrofits**
 - Existing building addition
 - Renovations
 - System retrofits/upgrades
- **Existing Buildings**
 - No additions, renovations or retrofits planned
 - Operational & maintenance problems
 - Comfort issues
 - Equipment failure
 - Conformation of systems operation to design intent
 - Change in occupancy and use over period of time
 - Energy savings

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Why Commission Construction Projects?



Source: Image and Content AABC Commissioning Group (ACG),

Texas Energy Engineering Services, Inc. (www.teesi.com)

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Why Commissioning? (cont.)

- Increased complexity of building systems plus:
 - Technological advances
 - More stringent code and standards
 - Demands for improved IAQ
 - Demand for improved comfort
 - Savings (Operational & Construction Costs)
 - Increased interaction between various trades
 - Fast track design and construction schedules
 - Substantial completion
 - Seasonal verification
 - Functional Testing
 - Project requirement and/or needs
 - LEED , Energy STAR, ISO 5001 and other

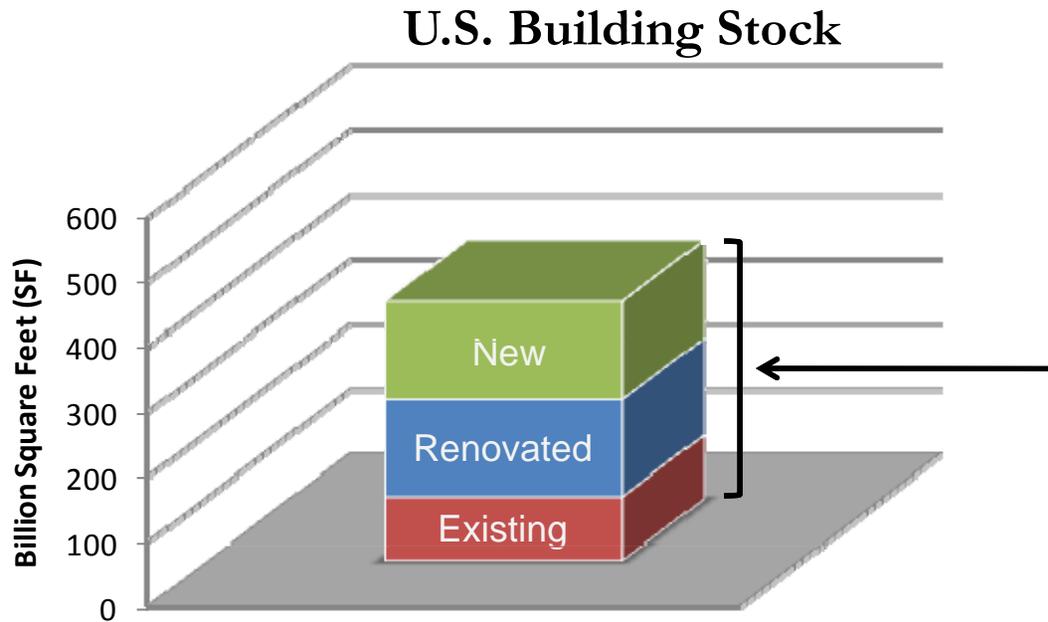
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Commissioning (Cx) - Objectives & Benefits

- Objectives/benefits of Commissioning
 - Minimize building turnover transition period
 - Reduction of change orders and delays
 - Minimize energy and operating costs
 - Accept optimized building
 - Minimize warranty issues
 - Project completion on schedule and within budget
 - Increased occupant and owner satisfaction
 - Extension of equipment/systems life cycle
 - Quality assurance approach resulting in significant value to owner

Industry sources indicate that on average the operating costs of a commissioned building range from 8% to 20% below that of that of a non-commissioned building (GSA The Building Commissioning Guide)

U.S. Building Stock Projections



Source: Graph Presented in 2030 Challenge, www.architecture2030.org based on data from the U.S. Energy Information Administration

By year 2035, three quarter of the U.S. Building Stock will be new or renovated.

Building offer the greatest opportunity for Energy Conservation.

Historic opportunity to improve energy efficiency and promote sustainable building practices.

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Commissioning Provider & Certifications

- Commissioning provider must have essential qualifications, background and experience with providing such services.

- Certifications and Organizations
 - Individual, firm or both
 - Building Commissioning Association (BCA), Associated Air Balance Council (AABC)-Commissioning Group (ACG), Association of Energy Engineers (AEE), Texas A&M- ESL (CC®), University of Wisconsin, National Environmental Balancing Bureau (NEBB) and Others

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Commissioning (Cx) - Misconceptions

- **Cx is “NOT”**
 - Covered under the traditional design professional services agreements
 - Testing, adjusting and balancing (TAB)
 - Verification of Contractor’s QA or QC program
 - Limited to HVAC & Controls
 - Substitute for construction inspection
 - Substitute for construction management
 - MEP systems coordination alone

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Typical Commissioned Systems

The scope of work is usually determined by the owner; however the following systems/equipment are typically included:

- **Mechanical Systems**
 - HVAC (Heating, Ventilation, Air Conditioning, Ducting & Accessories)
 - Piping Systems (Pipe, Valves, instrumentation, etc.)
 - Plumbing (Hot water heaters/boilers, fixtures etc.)
 - DDC Controls (Software programming and Hardware)
- **Electrical Systems**
 - Switchgear/Transformers
 - Grounding/Bonding
 - Lighting and lighting control
- **Specialty Systems**
 - Security and Fire Alarm Systems
 - Voice/Data Systems
 - Standby Power Systems
- **Other**

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Types of Commissioning (Cx) Services

- **New Construction & Renovation Commissioning**
 - **Comprehensive Cx**
 - Planning, design, construction and post acceptance phases
 - Total Building Cx
 - **Construction Phase Cx**
 - Construction and post acceptance phase
- **Existing Building Commissioning**
 - **Retro-Commissioning (RCx)**
 - Auditing
 - Facility commissioned for the first time
 - **Re-commissioning**
 - Facility previously commissioned

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Types of Commissioning (Cx) Services (cont.)

- **Continuous Commissioning (CC[®])** : Continuous Commissioning is an ongoing process to resolve operating problems, improve comfort, optimize energy use and identify retrofits for existing commercial and institutional buildings and central plants (Source: US DOE Continuous Commissioning Guidebook for Federal Energy Managers)
 - Existing Buildings
 - HVAC & Controls

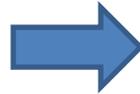
- **Ongoing Commissioning**
 - Process established to do commissioning over period of time

- **LEED Commissioning**

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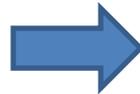
Construction & Existing Buildings - Cx Activities

Pre-Design



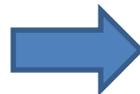
- » Activities to make Cx integral part of the project
- » Establish scope, probable costs and time requirements

Design



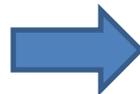
- » Preparation of Cx plan based on final design information
- » Develop Systems Verification Checklist (SVC) and Functional Performance Tests (FPT)

Construction



- » Cx plan implementation, interaction between construction team, Commissioning Authority and Design team
- » Coordination, Resolution Tracking, Observe Installation, BAS point verification, T&B, SVCs, and documentation

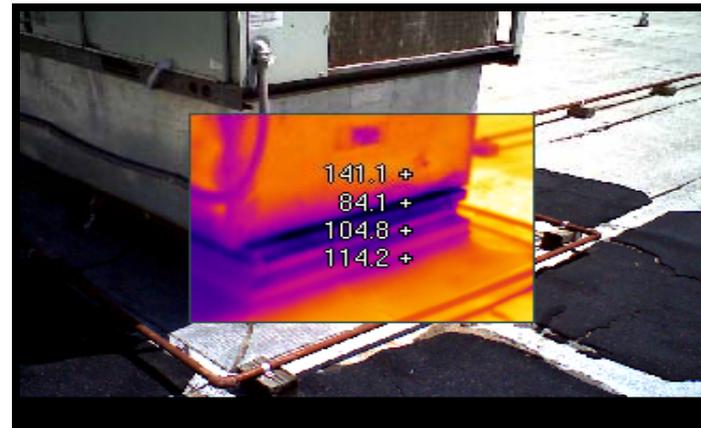
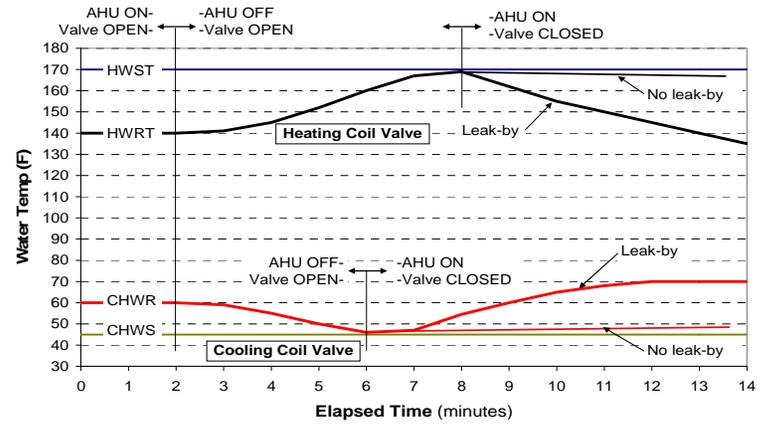
Acceptance /
Post Acceptance



- » Carry out FPTs, O&M staff training
- » Warranty
- » Carry out “off season” tests, update documentation

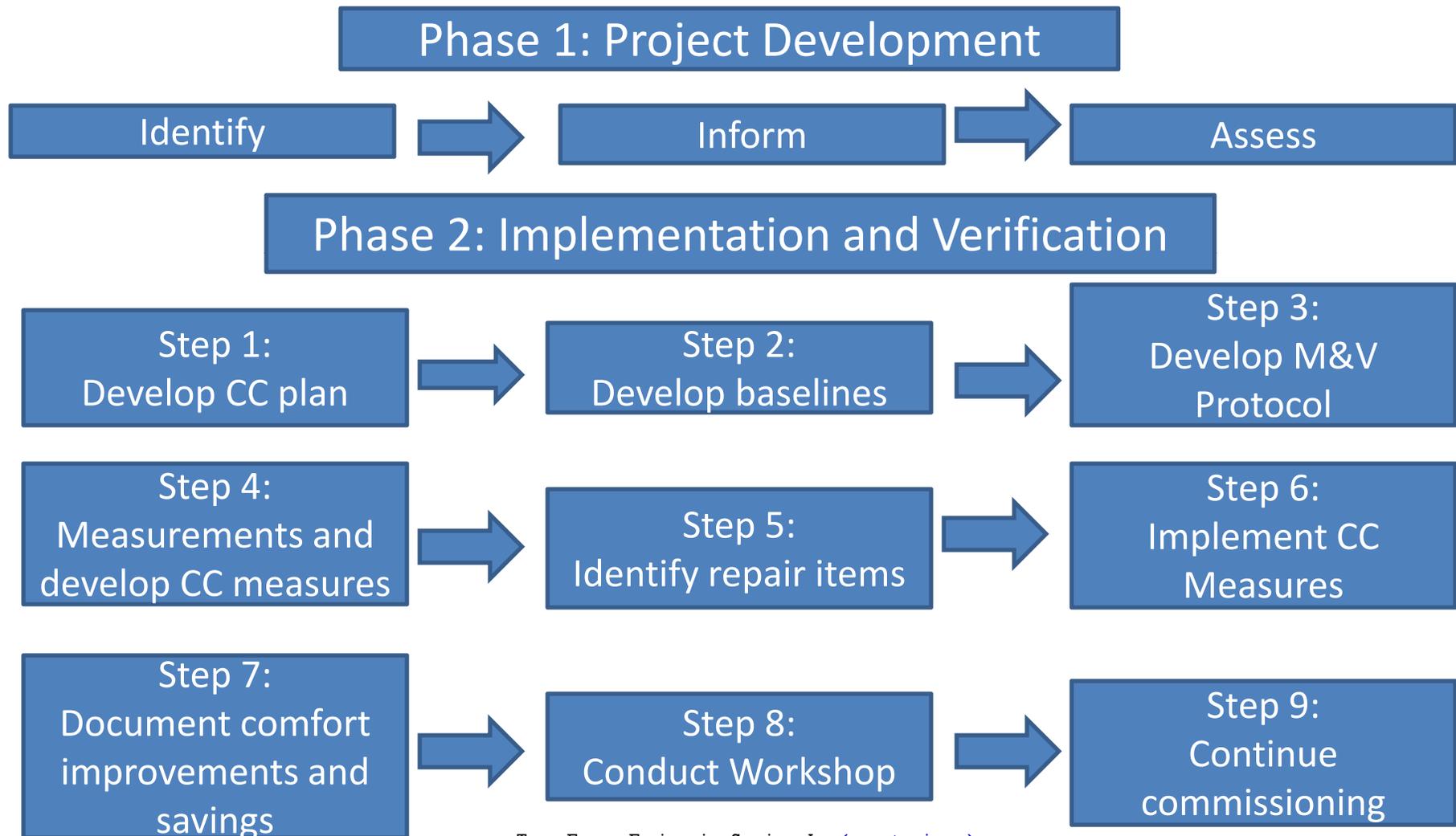
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Construction Projects Commissioning



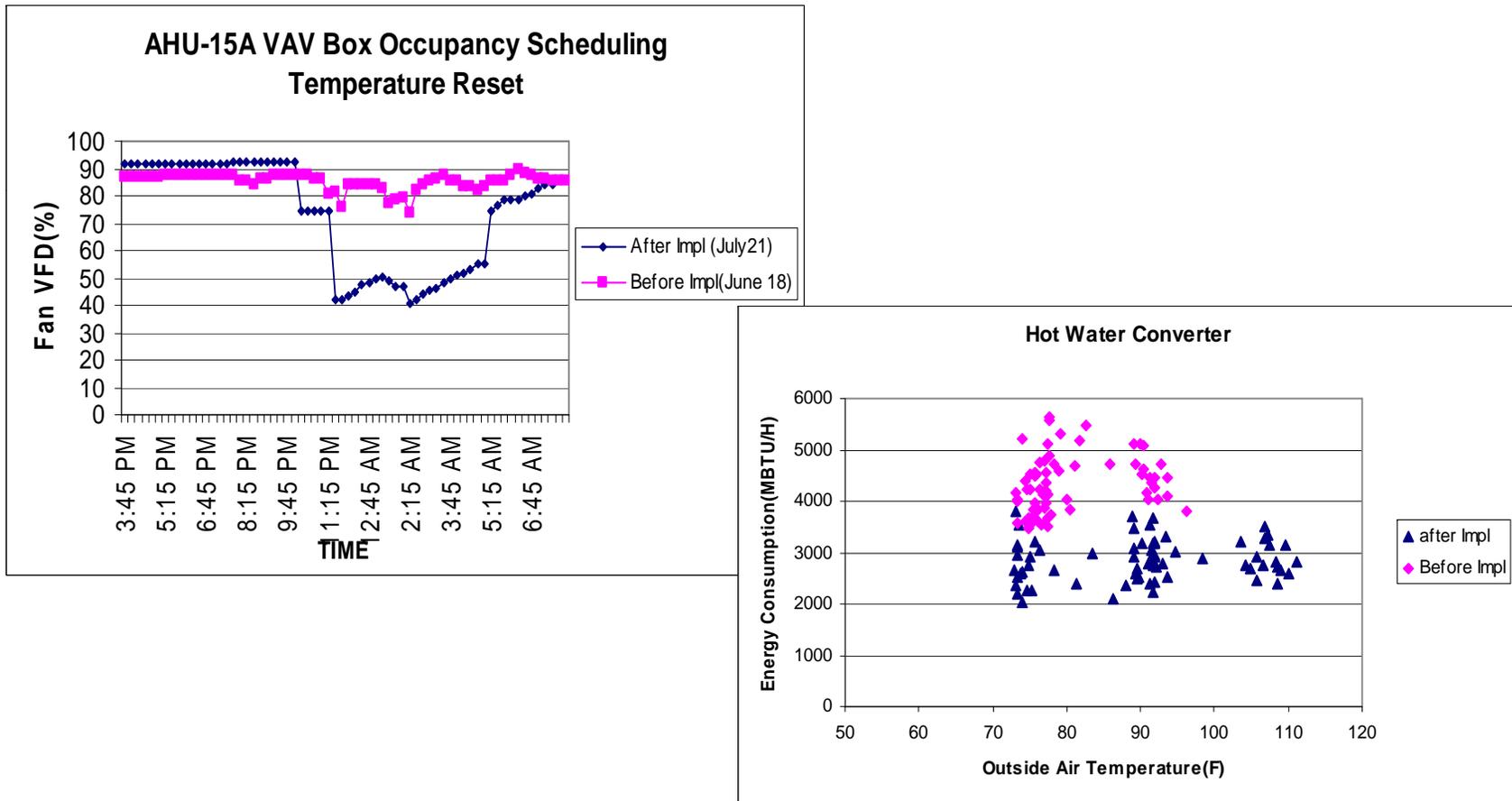
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Continuous Commissioning Activities & Phases



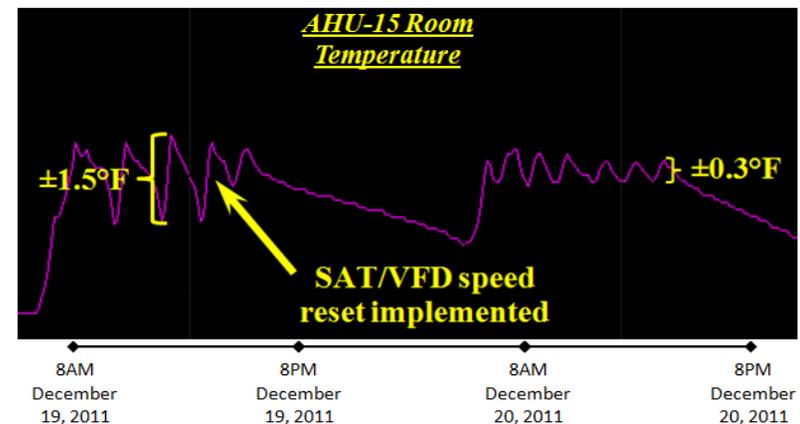
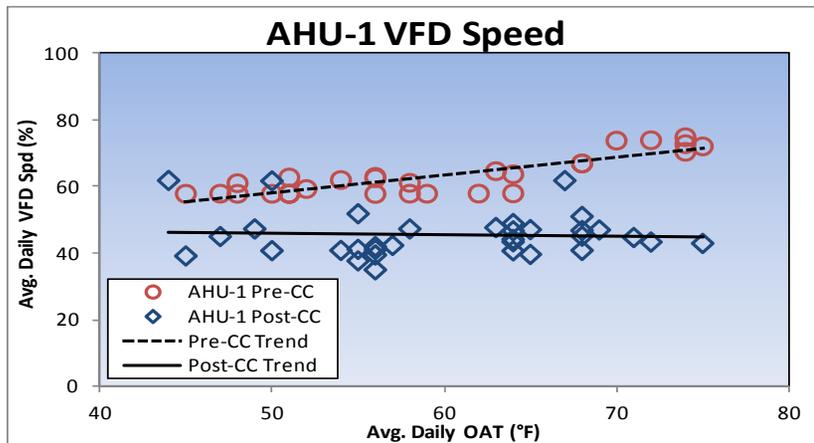
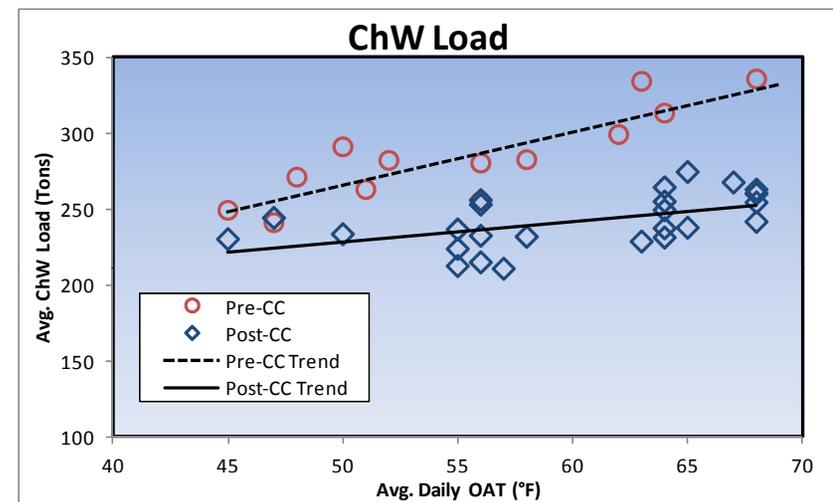
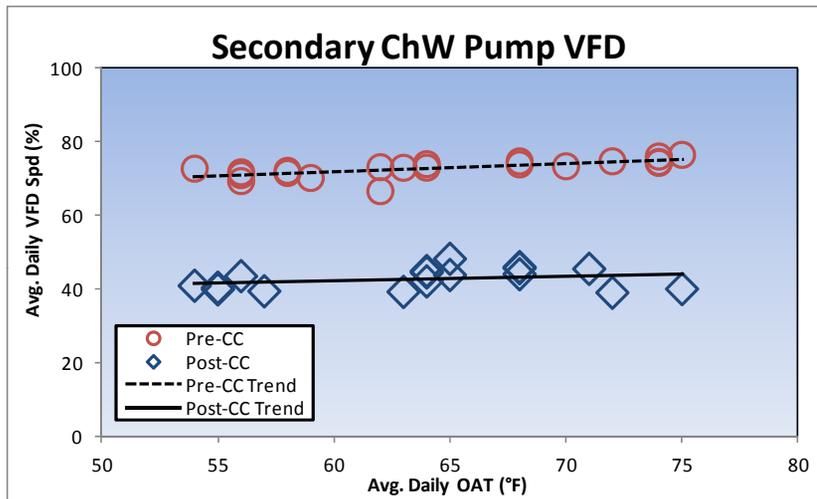
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Cx Implementation Monitoring Examples



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Cx Implementation Monitoring Examples (cont.)



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***Commissioning (Cx) Process Selection
Considerations***

- **Project**
 - **New Construction/Renovation**
 - **Existing Building**
- **Define Objective**
 - **Primary Objective(s)**
 - **Secondary Objective(s)**
- **Scope**
 - **What systems to commission?**
 - **What extent?**
 - **Reporting**
- **Budget Allocation**

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Cx Process Selection Consideration (cont.)

- **New Construction & Renovations**
 - Industry acceptable approach
 - Comprehensive or construction phase commissioning
- **Existing Building**
 - **Retro-commissioning (RCx)**
 - HVAC, Controls and other MEP systems
 - **Re-commissioning**
 - **Continuous Commissioning[®] (CC[®])**
 - HVAC and Controls
 - **Ongoing Commissioning (OC) &/or combination approach**

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Costs of Commissioning

Estimated Commissioning Authority Costs to Owner for Construction and Occupancy/Operation Phases

<u>Commissioned Systems</u>	<u>Total Commissioning Cost</u>
HVAC and Controls ^a	2.0 to 3.0% of mechanical
Electrical Systems ^b	1.0 to 2.0% of electrical
HVAC, Controls and Light Electrical	0.5 to 1.5% of construction

^a Source: Wilkison, R. (2000) Establishing Commissioning Fees, ASHRAE Journal 42 (4): 41-47

^b Source: PECEI, 2000. The National Conference of Building Commissioning Proceedings, Portland Energy Conservation Inc. OR.

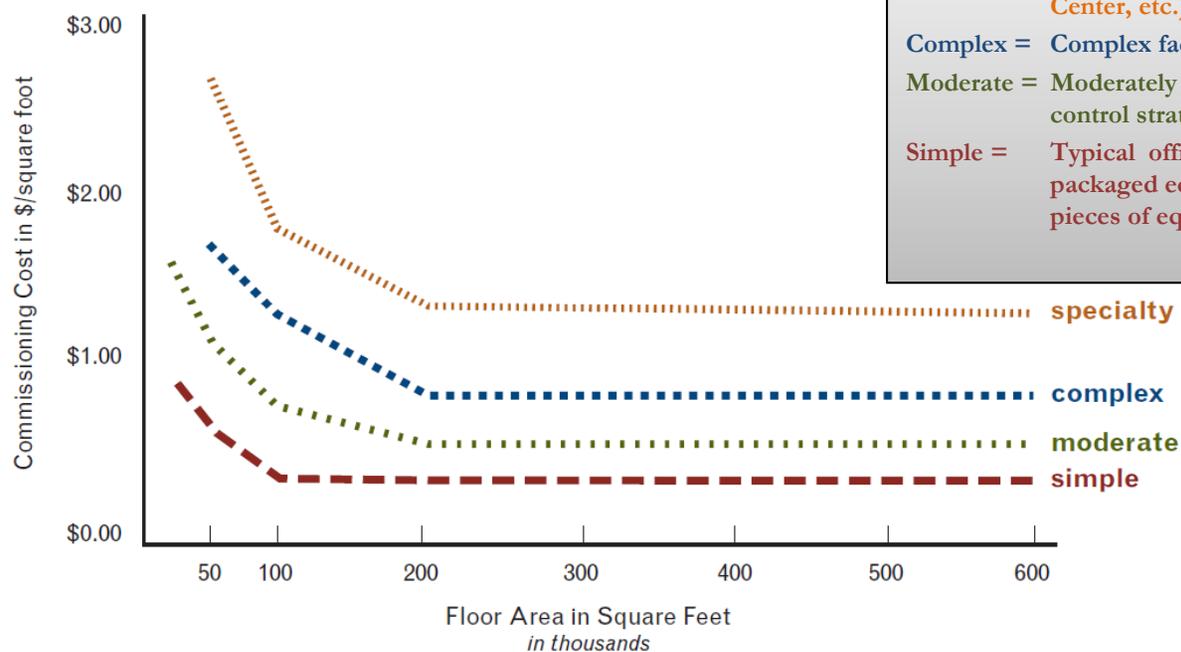
Printed in New Building Commissioning, 2003 ASHRAE Applications Handbook, 42.10

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Cost of Commissioning (cont.)

Benchmark Commissioning Costs by Facility Type

Estimates of Construction Phase Commissioning Costs



Specialty = Very complex facility (Mission Control Center, etc.)
Complex = Complex facility (Hospitals, labs, etc.)
Moderate = Moderately complex building with advanced control strategies and systems
Simple = Typical office buildings, classrooms, packaged equipment and controls; fewer pieces of equipment.

Source: Portland Energy Conservation, Inc. (PECI), 2000,

Printed in General Service Administration, The Building Commissioning Guide, April 2005.

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Useful Resources

Associated Air Balance Council (AABC) & ACG (AABC Cx Group)

- www.commissioning.org

Building Commissioning Association (BCA)

- www.bcxa.org

American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE)

- www.ashrae.org

National Institute of Building Sciences

- www.nibs.org

Portland Energy Conservation Inc. (PECI)

- www.peci.org

U.S. Green Building Council

- <http://www.usgbc.org/>

U.S. Department of Energy

- <http://www1.eere.energy.gov/buildings/commercial/commissioning.html>

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Discussion and/or Questions?

Saleem Khan, P.E., CxA
(512) 328-2533
Email: Saleem@teesi.com