
AABC Commissioning Group

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Benchmarking and Operational Achievements at Willis Tower

Course Number: CXENERGY1907



Rick Walls CxA
Rivion, LLC

Rock Ridolfi
Rivion, LLC

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Course Description

Over several months of rigorous investigation and benchmarking, Rivion assisted Willis Tower, formerly known as Sears Tower, with achievement of their first ENERGY STAR certification, becoming the largest office building ever to achieve this recognition. Building upon this framework, Rivion guided the 4.5 million square foot property through two simultaneous LEED Gold certifications in both version 2009 and the newest version 4.1 rating systems in October of 2018. We will discuss the challenges faced by the property throughout these certification processes and the strategies used to overcome them to make the “impossible” possible.

Learning Objectives

At the end of this course, participants will be able to:

1. Utilize ENERGY STAR Portfolio Manager as part of a comprehensive benchmarking strategy
2. Identify multiple strategies to investigate building operations
3. Prepare and account for deficiencies identified during operational improvement projects
4. Apply lessons from the case study's successes and challenges on future projects

Willis Tower

4.5+ million square feet in size

1,450 feet (443 meters); 110 floors

2nd tallest in the U.S.

12th tallest building in the world





What's Up?

More than \$500 M renovation

New building automation system

High-efficiency lighting systems and improved controls

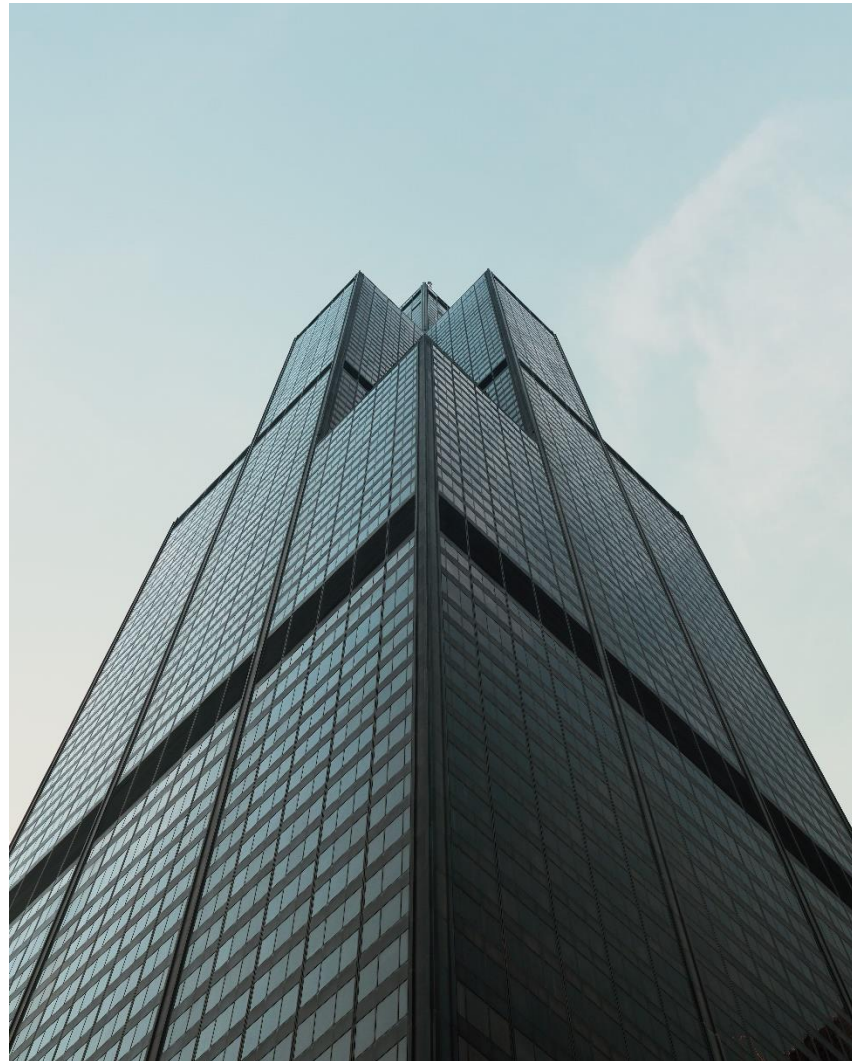
HVAC exhaust & return damper improvements

All new air media and variable frequency drives

Chiller modernization

Enhancing the electrical infrastructure integrity

LEED Gold



ENERGY STAR

Benchmarking



ENERGY STAR Benchmarking

Space types & square footages

Operating hours/ occupancy hours

Occupant counts

Accurate build - low score



Building Operations



Best Practices

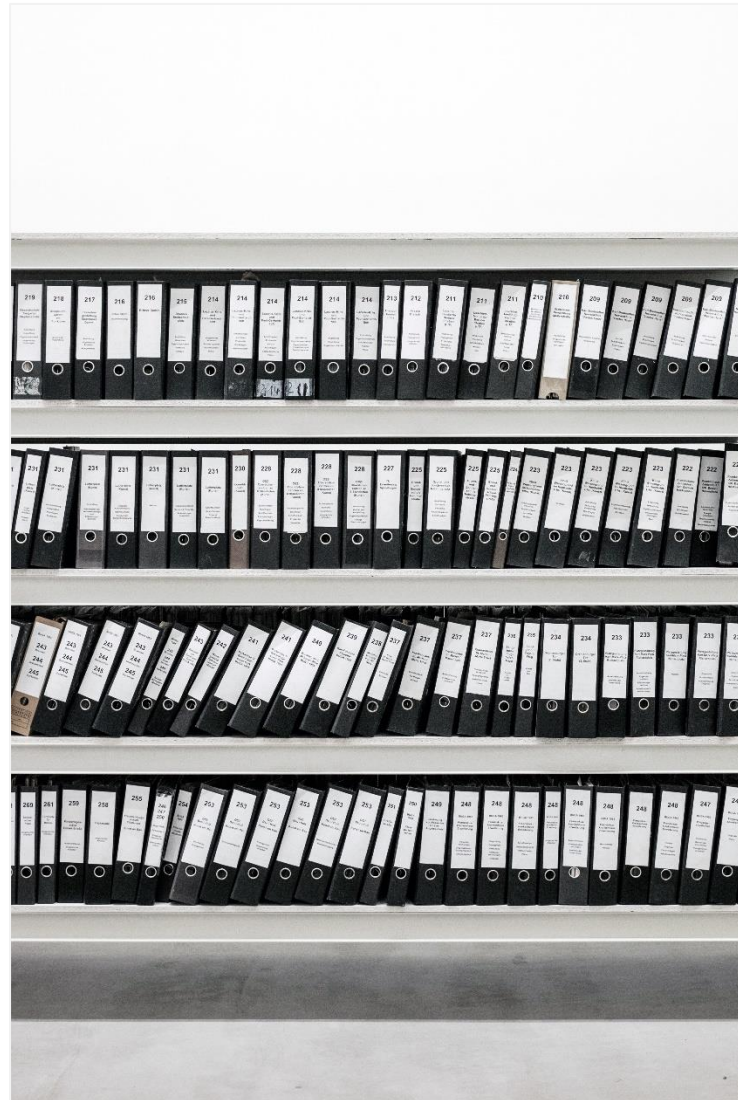
Operational Documents

Building Operating Plan

Systems Narrative

Sequence of Operations

Building Drawings



Building Operating Plan (BOP)

Provides Occupancy Conditions – Hours of Operation, Space Temperature and Humidity Setpoints, Levels

Mechanical Equipment Runtime Hours to Meet Occupancy Conditions.

Aligns Building Operation Team with Building Management team.

Organized by Functional Building Areas

- Tenant Areas

- Building Usage – Offices, Parking, Data Rooms, Restaurants, Gyms

- Mechanical System Divisions

- EnergyStar Profile

Systems Narrative

Written Description of MEP Systems to Provide the Conditions Defined in the BOP

Describes Production Equipment and Delivery Systems for

- Space Heating

- Space Cooling

- Ventilation

- Lighting

- Domestic Hot Water

- Mechanical Systems Controls

- Lighting Systems Controls

Organized by Functional Building Areas to Match Building Operating plan.

Can Include Equipment Locations, Control Equipment Locations, Domestic Hot Water Locations

Sequences Of Operation

Description of the MEP systems operation to meet the Building Operating Plan.

Documents Should be Updated on a Consistent Basis:

- Tenant Modifications

- System or Equipment Modifications

Building Drawings

Document the Original Building with As-Built Drawings

Keep the Drawing Set Up to Date:
 Mechanical Equipment Updates
 Tennant Improvements
 Hard Copy to Electronic

Best Practices

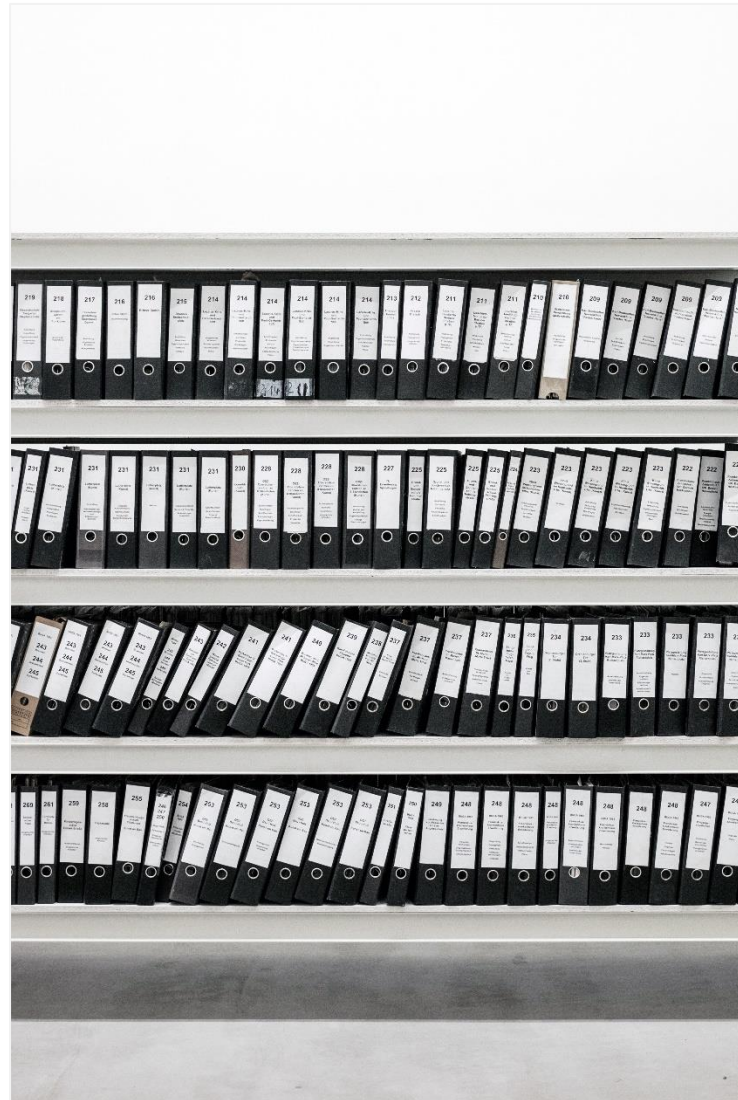
Operational Documents

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Building Automation Review Goals

Evaluate Building Automation System (BAS) Status and Health

Identify Possible Equipment or Operational Issues

- Nuisance Alarms

- Overridden System Points

- Systems Outside of Control Points

- Operator Training Gaps

Identify Energy Conservation Measures

- Reduce Equipment Runtimes

- Improved Equipment Setpoints

- Energy Saving Sequence Of Operation Improvements

Building Automation Review

Findings

Multiple Systems with Multiple Workstations

- Existing Base Building System – ESUSA with CSI Inet
- Tenant Improvements and Updates - Trane

Operations Team is Very Hands On With Building Automation System

- The ESUSA system is used like a time-clock

Ongoing Base Building Automation Update Project

- Updated Sequence of Operation
- More Automatic Control of Systems

Ongoing Tenant Improvements

Night Audit

Mechanical systems

Tenant equipment

Lighting and Levels

Large Energy Users



After-hours Findings

Unoccupied Spaces Were Often Lit and Conditioned to Occupied Levels

Vacant Spaces Were Used to “Dump” Conditioned Air During After-Hours Operation

- Building Floors have Isolation Dampers

- Mechanical Systems Lack the Ability to Reduce Capacity to Acceptable Levels

Tenant Televisions and Computer Equipment Remain On Continuously

Large Commercial Coffee Makers Remain On Continuously

- 1550 Watts to 1800 Watt per units

Blinds and Shades are Underutilized on unoccupied and vacant spaces.

After-hours Findings

Low Cost and No Cost ECMS Were Challenging to Locate.

Very Few Issues with the MEP Systems.

At Willis Tower, all ECMS are Capital Improvements.

No Obvious Large Energy Consumers...



Accounting for Deficiencies



Outdoor Air Review

Required by LEED, good habit
before audit

Fixing equals energy

AHU survey

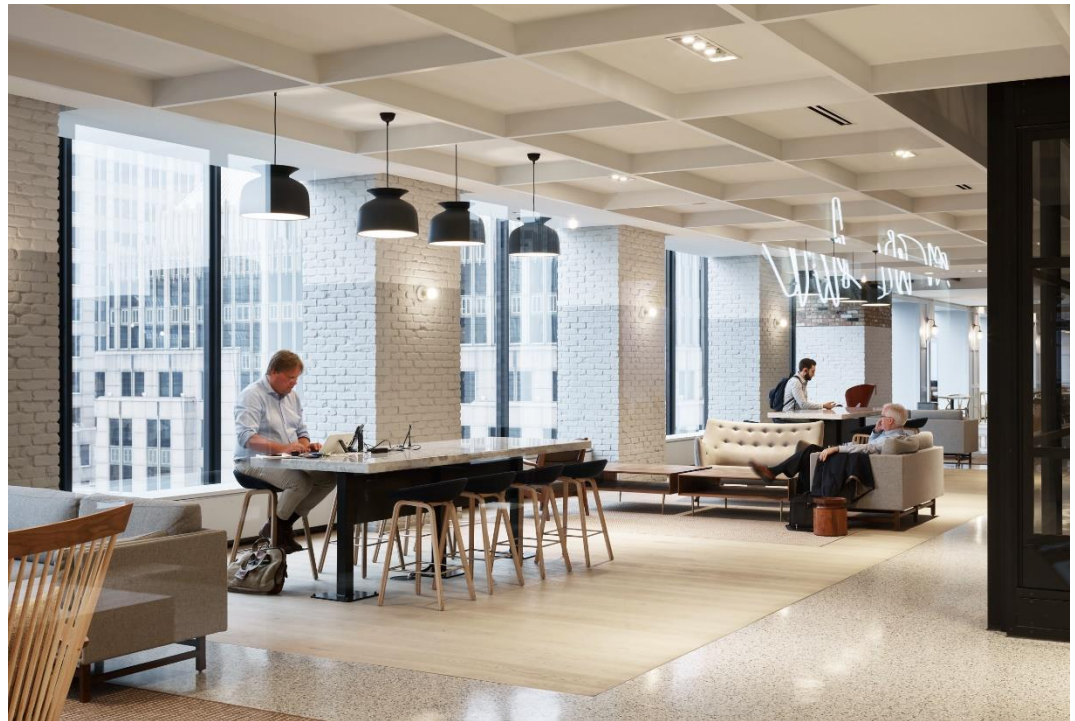
Sizing

Usage vs. drawings

Issues

Changes over time

“They’re already on it”



Critical Zones & IAQ

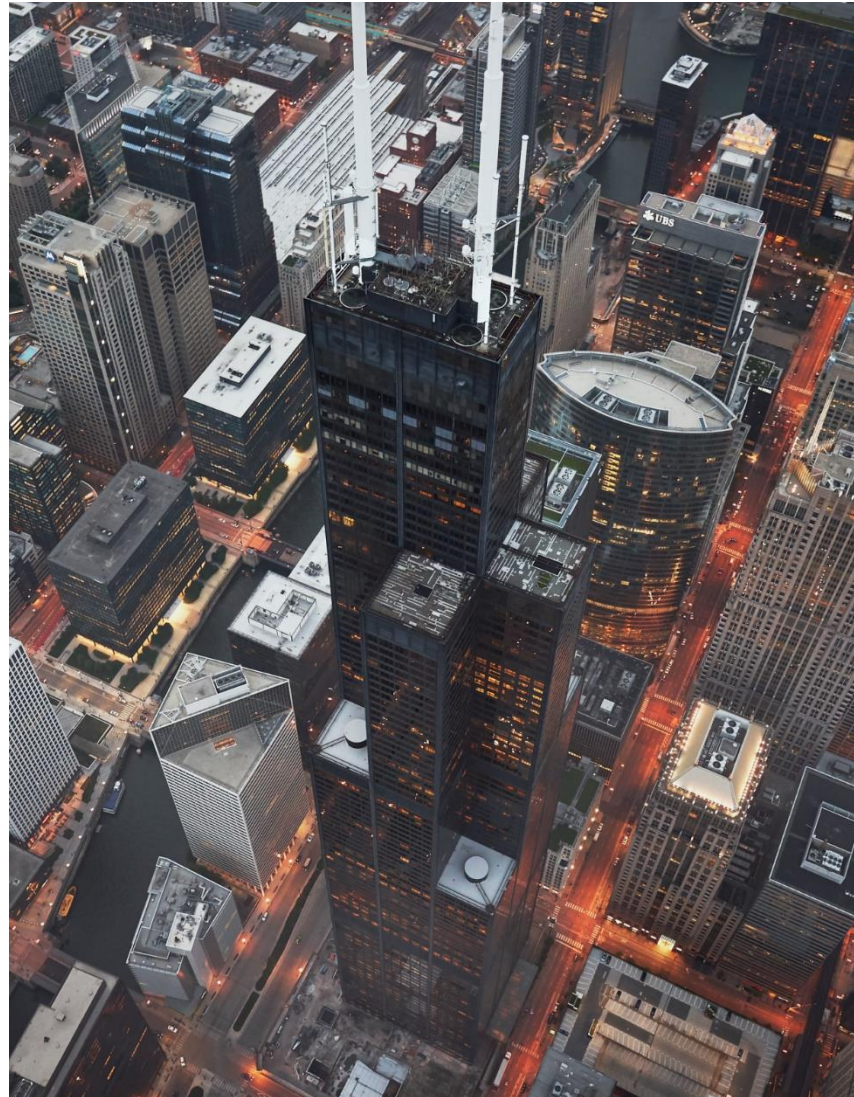
Design vs. real-time space usage.

First Hand Staff and Tenant

Update Building Requirements

Single-Tenant in 1973

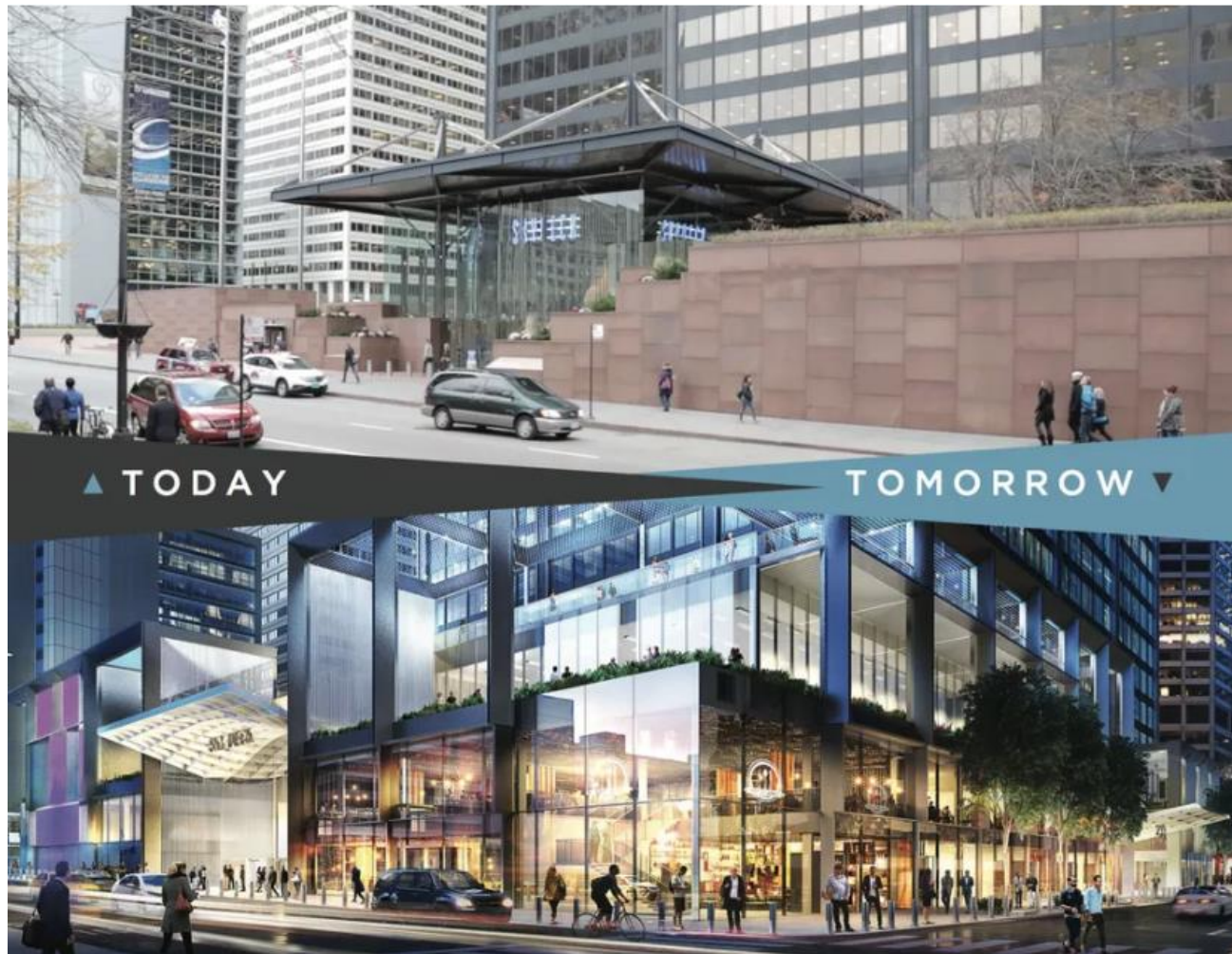
Multi-Tenant Multi-Use in 2018



Applying Lessons



Preparing for the Future



Before [top] and after [below]. Blackstone/Gensler

Preparing for Change

Benchmark now
Understand the future

Occupancy & operations

Truly automating

All the meters!



Keeping Track

Best practice documentation

ENERGY STAR

LEED v4.1 performance



Q&A



This concludes The American Institute of Architects
Continuing Education Systems Course

Rick Walls

1-414-455-5395 • Rick.Walls@rivion.com

Samantha Longshore

1-414-937-5029 • Samantha.Longshore@rivion.com

