

Building Performance Assessment Guide

A Practical Framework for Facility Managers & Building Owners

Prepared by Zytona — Building Performance & Commissioning Specialists

4 Assessment Sections

Energy · HVAC · IAQ · Commissioning

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Introduction: The Foundation of Building Improvement

Every meaningful building improvement initiative begins with the same question: *Where do we stand today?* Without a clear, data-driven understanding of current performance, facility managers and building owners operate in the dark—making decisions based on assumptions, vendor recommendations, or the loudest complaint rather than objective evidence.

Building performance assessment provides the diagnostic foundation that transforms reactive management into strategic investment.

30–50%	More maintenance spending in reactively managed buildings vs. proactive programs (National Institute of Building Sciences)
3–5x	Higher cost of emergency repairs vs. planned maintenance
15–30%	Typical utility cost waste in buildings that have never undergone systematic assessment

Beyond cost, assessment reveals comfort problems before they drive tenant complaints, identifies code compliance gaps before they trigger violations, and documents equipment conditions before catastrophic failures disrupt operations. The assessment process itself creates accountability—establishing baselines against which future improvements can be measured and verified.

Section 1: Energy Performance Assessment

Establishing an Energy Baseline

Accurate energy assessment begins with data collection. Gather complete utility records covering a minimum of 12 months, though 24 months provides better insight into year-over-year patterns and helps distinguish anomalies from trends. Collect the following for each meter serving the building:

- Monthly consumption (kWh for electricity, therms or CCF for natural gas)
- Monthly demand (kW) for electric accounts
- Billing period dates (actual days in each billing cycle)
- Rate schedules and any demand ratchet clauses
- Interval data if available (typically 15-minute increments)

Calculating Energy Use Intensity (EUI)

EUI normalizes consumption by building size, enabling comparison across facilities and against benchmarks.

$$\text{Site EUI} = \text{Total Annual Energy (kBtu)} \div \text{Gross Floor Area (sq ft)}$$

Convert electricity to kBtu by multiplying kWh by 3.412. Convert natural gas therms to kBtu by multiplying by 100.

Office Buildings	79.5 kBtu/sf median (CBECS)
Healthcare Facilities	192.2 kBtu/sf median (CBECS)
Retail Buildings	52.6 kBtu/sf median (CBECS)

Energy Star Portfolio Manager Setup

- Create an account at energystar.gov/portfoliomanager
- Add property with accurate address and year built
- Enter gross floor area measured to the exterior walls
- Input property use details (operating hours, occupants, number of computers for offices)
- Add meters for each utility type serving the property
- Enter 12 months of consumption data for each meter
- Generate an Energy Star score (1–100; buildings scoring 75+ qualify for certification)

Key Metrics Beyond EUI

<p>Peak Demand</p>	<p>The highest 15-minute average power draw during a billing period. High peak demand relative to average consumption suggests equipment simultaneously cycling, poor load sequencing, or demand spikes.</p>
<p>Load Factor</p>	<p>Calculate as $(\text{Total kWh} \div \text{Hours in Period}) \div \text{Peak Demand}$. Values below 0.40 indicate poor load management. Values above 0.60 suggest efficient, consistent operation.</p>
<p>Demand Profile Shape</p>	<p>Interval data reveals whether consumption patterns match occupancy. Flat 24-hour profiles despite scheduled occupancy indicate systems running unnecessarily.</p>

■ Red Flags — Performance Warning Signs

- Site EUI exceeding benchmark median by more than 25%
- Rising EUI trend over consecutive years without operational changes
- Winter electric consumption approaching summer peaks (suggests electric reheat issues)
- Baseload exceeding 40% of peak-hour consumption
- Demand charges exceeding 30% of total electric bill
- Natural gas consumption during cooling season (unless process loads exist)

Section 2: HVAC System Assessment

Equipment Inventory & Age Assessment

Begin with a complete inventory of HVAC equipment. For each major component, document:

- Equipment type, manufacturer, and model number
- Serial number and manufacture date (often encoded in serial number)
- Nameplate capacity (tons, CFM, MBH, HP)
- Original installation date and physical location/tag number
- Service history summary

Compare equipment age against ASHRAE median service life data:

Chillers	20–25 years
Rooftop Units	15–20 years
Boilers	25–35 years
Variable Frequency Drives	15–20 years

Field Observation Checklist (10-Point Walkthrough)

- **Air Handler Coils:** Check for fouling, biological growth, and fin damage. Dirty coils reduce capacity 20–40%.
- **Belt Condition:** Inspect for cracking, glazing, and proper tension. Worn belts reduce airflow and efficiency.
- **Filter Condition:** Note pressure drop across filters. Confirm filter type matches specification.
- **Ductwork Integrity:** Check accessible ductwork for disconnected sections, open access doors, and damaged insulation.
- **VAV Box Operation:** Verify damper movement when adjusting setpoint. Listen for hunting or chattering.
- **Thermostat Location:** Confirm sensors are away from heat sources, exterior walls, and direct sunlight.
- **Condensate Drainage:** Inspect drain pans and traps for standing water and biological growth.
- **Refrigerant Lines:** Check insulation integrity and look for oil stains indicating leaks.
- **Equipment Nameplate Accessibility:** Confirm all equipment can be identified for maintenance purposes.
- **Vibration and Noise:** Note unusual sounds indicating bearing wear, imbalance, or component failure.

Controls and BAS Assessment

- Document BAS age, manufacturer, and software version
- Assess graphics completeness and usability
- Confirm trending capability and data retention period
- Check remote access functionality
- Inventory connected points versus standalone controls
- Evaluate sequence of operations documentation availability
- Test alarm notification functionality

Section 3: Indoor Air Quality Assessment

Parameters to Measure

Carbon Dioxide (CO₂)	Primary ventilation indicator. Target indoor levels 500–700 ppm above outdoor baseline per ASHRAE 62.1. Concentrations exceeding 1,000 ppm above outdoor suggest inadequate outdoor air delivery.
Temperature	Per ASHRAE Standard 55: 68°F–76°F (winter) and 73°F–79°F (summer) for typical sedentary office conditions.
Relative Humidity	Target 30–60%. Below 30% causes discomfort; above 65% promotes microbial growth (ASHRAE recommendation).
Carbon Monoxide (CO)	Indicates combustion byproduct infiltration. Must remain below 9 ppm as an 8-hour average (EPA NAAQS).
Particulate Matter (PM_{2.5})	EPA recommends indoor levels below 12 µg/m ³ annual average, with 35 µg/m ³ as a 24-hour limit.
Total VOCs (TVOCs)	No regulatory indoor standard exists, but levels below 300 µg/m ³ are generally considered acceptable.

Occupant Survey Methodology

- Use validated instruments from the Center for the Built Environment (UC Berkeley)
- Survey timing should avoid periods immediately following complaints
- Anonymous responses increase candor and data quality
- Include questions about thermal comfort, air quality, lighting, and acoustics
- Ask about symptom frequency (headache, fatigue, eye irritation)
- Map responses by location to identify problem zones

Section 4: Commissioning Status Review

Documentation Audit

Comprehensive commissioning generates specific deliverables. Audit project records for these key documents:

Owner's Project Requirements (OPR)	Defines the owner's expectations for building performance, function, and operation. Forms the basis for all commissioning verification.
Basis of Design (BOD)	Documents how design decisions address OPR requirements. Links design intent to testable outcomes.
Commissioning Plan	Describes scope, schedule, roles, and specific testing procedures. Should include checklists for each system.
Commissioning Report	Documents all testing, results, and resolution of identified deficiencies. Should include functional test procedures with actual annotated results.

Buildings constructed to LEED certification requirements after 2005 should have all four documents. Absence suggests either non-commissioned construction or poor record retention.

Functional Test Verification

Select representative systems and reverify commissioning test results:

- Review original functional test procedures and documented results
- Repeat key sequences (economizer changeover, staging, failure modes)
- Compare current response against original documented performance
- Note any sequences that have drifted from design intent

Performance Drift: Systems typically require recommissioning every **3–5 years** to maintain original performance levels. Performance drift is normal over time.

Deferred Deficiencies Tracking

Commissioning reports often include deficiencies deferred for later correction. Create a formal tracking register that captures each open item, the responsible party, target resolution date, and current status. Review the register at each commissioning meeting and confirm all items are resolved before system acceptance.

About Zytona

Zytona is a building performance and commissioning specialist firm helping facility managers and building owners improve energy efficiency, occupant comfort, and system reliability through data-driven assessment and targeted improvement programs.