Introduction to Energy Management

Module 1 in the "Benchmarking and Energy Management for K-12 Facility and Energy Managers" Course

October 17, 2023

Today's Presenter

Andrew Schulte

Mr. Schulte is a Director in ICF's Energy Efficiency and Sustainability group, with nearly 18 years of experience. In support of the U.S. Environmental Protection Agency's (EPA's) ENERGY STAR Buildings program, Mr. Schulte assists partners seeking to integrate ENERGY STAR tools and resources, including the Guidelines for Energy Management and Portfolio Manager, into organization-wide energy and sustainability strategies. He has also led the development, delivery, and evaluation of the ENERGY STAR Buildings training program, and has presented hundreds of benchmarking and energy management trainings over the course of his career. Mr. Schulte also supports engagement with service and product providers that are helping building owners and operators to develop and execute energy management projects.

Today's Agenda

- Welcome and Introductions
- Learning Objectives
- Key Terms
- Energy Basics
- Principles of Energy Management
- Frameworks for Organizational Energy Management
- Other Key Resources
- Wrap-up and Q&A

# Overview of the Benchmarking & Energy Management Course

- **October 17, 2023: Introduction to Energy Management**

- October 24, 2023: Energy Tracking and Benchmarking

- October 31, 2023: Developing Energy Efficiency Projects

- November 7, 2023: Institutionalizing Continuous Improvement

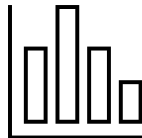- November 14, 2023: Benchmarking & Energy Management Cohort
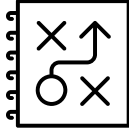
All sessions will take place from 3:00 – 5:00 PM (Eastern)

Learning Objectives

- In today's session, attendees will:

  - Understand common terms and concepts related to energy consumption and energy management in buildings

  - Identify and become familiar with guiding principles of energy management

  - Learn about key frameworks and associated resources for energy management
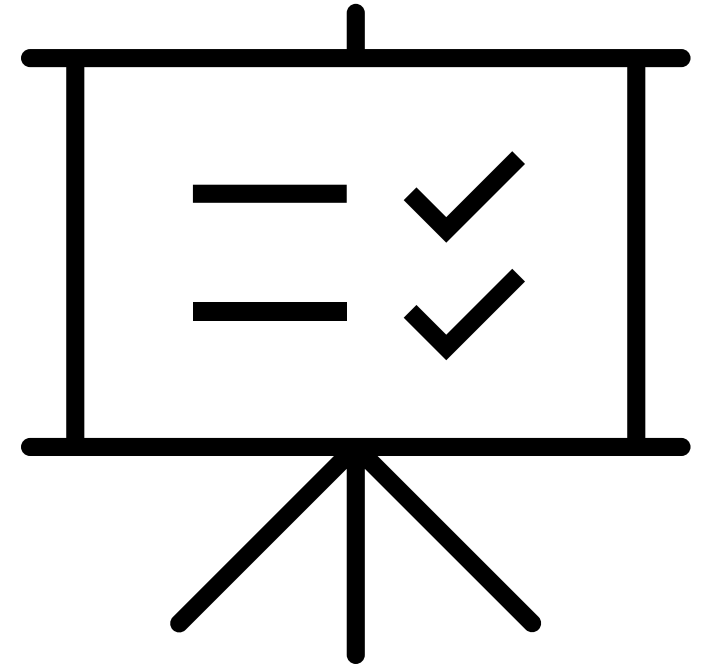
Key Terms Used in This Course

Key Terms

- ## Energy Management

  - A **systematic** and **strategic** process through which the energy performance of a property or group of properties is tracked and analyzed, and the resulting information is used to inform decisions that will result in the **continuous improvement** of key indicators (including, but not limited to energy use and energy use intensity, energy cost, and greenhouse gas emissions).

- ## Energy Benchmarking

  - The process of measuring and tracking energy data for a property or portfolio of properties over time, in order to **identify and assess changes** in performance and/or to **compare performance** against other similar properties.

Key Terms

- ## Energy Assessment

  - A process through which core drivers of a property's energy performance (including systems/equipment, as well as operational practices) are assessed and documented to **identify, quantify, and prioritize recommended improvements.**

- ## Operations and Maintenance (O&M)

  - Ideally, a **regular and ongoing** process through which building systems are kept in good working order and smaller issues are identified and resolved **in the course of day-to-day operations**, before they become larger problems.

Key Terms

- Low- and No-Cost Measures
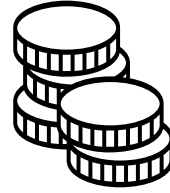
  - Energy improvement activities for which **the up-front cost of implementation is low and/or the payback time is sufficiently rapid**, resulting in a more rapid and streamlined approval process.

- Capital Expenditures
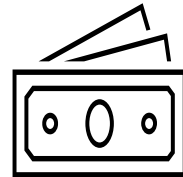
  - **Larger/more comprehensive** energy improvement measures that require **advanced planning and approval** and may involve **financing** or other payment structures beyond the operating budget.

Key Terms

- ## Retrofits

  - Energy improvement activities that **build upon or improve existing systems/equipment**, in order to achieve incremental savings compared to existing system performance.

- ## Replacement

  - Energy improvement activities that entail the removal of existing building systems/equipment and **the installation of newer and/or more efficient equipment.**

Key Terms

- Project Evaluation
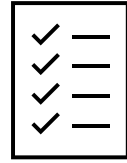
    - A process by which reported energy savings from a given project or group of projects are **validated for accuracy and additionality** (i.e., "would these savings have occurred without the project in question?")

Understanding the Basics of Energy Consumption

Energy Types

- ## Direct
  - ### Purchased fuels that must be combusted onsite to produce the energy required to operate equipment.
  - ### E.g., natural gas, fuel oil, propane, diesel.

- ## Indirect
  - ### Purchased energy that has already been converted/generated from raw fuel(s) and can be used immediately to operate building equipment.
  - ### E.g., grid electricity, steam/hot water/chilled water purchased from a district energy provider.

Energy Types, cont'd.

- Onsite Renewable Energy
  - Generated <u>at the property</u> using renewable technologies (e.g., solar PV, solar hot water, wind).
  - Reduces the amount of purchased and/or fossil energy that would otherwise be required to operate the property.

- Offsite Renewable Energy
  - Purchase of renewable energy that is not generated at the same location as it is consumed.
  - Many different "flavors" of offsite renewables.
  - Typically <u>does not</u> replace the need for grid electricity; important in the context of reducing reported emissions from building operation.

Energy Providers

- Traditionally Regulated Markets
  - Local utility companies responsible for <u>both</u> energy supply <u>and</u> the delivery of energy to customers.
  - Customers typically receive a single bill from their utility.

- Deregulated (Competitive) Markets
  - Customers can buy energy from competitive suppliers rather than the local utility.
  - Local utility companies remain responsible for delivery.
  - Customers may receive a single bill from the local utility <u>or</u> they may receive separate bills from the local utility and the competitive supplier.

Retail Electric Power Markets

☐ Traditionally Regulated
■ Competitive

Source:
https://www.epa.gov/greenpower/understanding-electricity-market-frameworks-policies

Energy Demand vs. Energy Consumption

- Demand
  - Typically measured in kW (or MW at the utility scale).
  - Point-in-time measurement of the rate at which your property is consuming electricity.
  - Demand charge is typically set by the peak demand recorded during the billing period.

- Consumption
  - Typically measured in kWh (or MWh at the utility scale).
  - Measurement of the total electricity used over a given period of time (e.g., kW * hours).

Source: https://www.we-energies.com/payment-bill/demand-charges

Billing
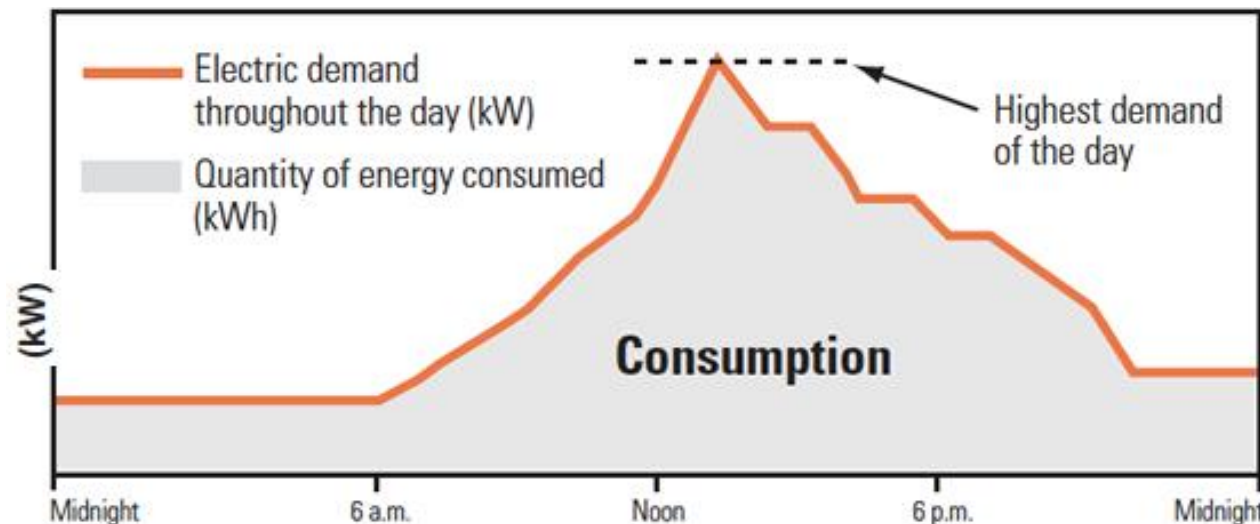
- Typical utility bill elements may include, but are not limited to:
  - Consumption
  - Demand
  - Supply charges
  - Delivery/distribution charges
  - Demand charges
  - System benefits charge (or other approved surcharges to fund specific programs/initiatives)
  - Additional charges associated with opt-in programs
  - Administrative costs
  - Taxes

Billing Detail Example – National Grid

SCEP STATE & COMMUNITY ENERGY PROGRAMS

Enrollment Information

To enroll with a supplier or change to another supplier, you will need the following information about your account:

Loadzone   NEMA/BOST

Acct No: ▮▮▮▮▮▮   Cycle: & DANA

Electric Usage History

Month	kWh	Month	kWh
Mar 21	02	Oct 21	04
Apr 21	02	Nov 21	03
May 21	02	Dec 21	140
Jun 21	04	Jan 22	246
Jul 21	03	Feb 22	300
Aug 21	02	Mar 22	249
Sep 21	03		

DETAIL OF CURRENT CHARGES

Delivery Services

Type of Service	Current Reading	-	Previous Reading	=	Difference	x	Meter Multiplier	=	Total Usage
Energy	66587 Actual		66338 Actual		249		1		249 kWh
							Total Energy		**249 kWh**

METER NUMBER ▮▮▮▮▮   NEXT SCHEDULED READ DATE ON OR ABOUT Apr 8

SERVICE PERIOD Feb 8 - Mar 8   NUMBER OF DAYS IN PERIOD   28

RATE   General Service - Small C/I G-1   VOLTAGE DELIVERY LEVEL   0 - 2.2 kv

Choosing an Energy Supplier You can choose who supplies your energy. No matter which energy supplier you choose, National Grid will continue to deliver energy to you safely, efficiently and reliably. We will also continue to provide your customer service, including emergency response and storm restoration. National Grid is dedicated to creating an open energy market that lets you choose from a variety of competitive energy suppliers, who may offer different pricing options. For information on authorized energy suppliers and how to choose, please visit us online at ngrid.com/ma-energychoice

Customer Charge			10.00
Dist Chg	0.06868275 x	249 kWh	17.10
Transition Charge	-0.00098569 x	249 kWh	-0.24
Transmission Charge	0.03035571 x	249 kWh	7.56
Energy Efficiency Chg	0.00938 x	249 kWh	2.33
Renewable Energy Chg	0.0005 x	249 kWh	0.12
Distributed Solar Charge	0.0036 x	249 kWh	0.90
Electric Vehicle Charge	0.00046 x	249 kWh	0.11
Total Delivery Services			**$ 37.88**

Supply Services

SUPPLIER National Grid

Basic Service Fixed	0.13113 x	249 kWh	32.65
Total Supply Services			**$ 32.65**

Source: https://www.nationalgridus.com/MA-Business/Help-Read-Your-Bill/How-to-Read-Your-Bill

Billing Detail Example – Duquesne Light Co.

Source: https://www.duquesnelight.com/docs/default-source/pdf-library/7137_dlc_bill_commercial_redesignjan62021.pdf

Consider Your Energy Goals

	Energy Savings	Cost Savings	GHG Reductions
Energy Efficiency	✔	✔	✔
Demand Response / Demand Management	(✔)	✔	(✔)
Renewable Energy	(✔)	(✔)	✔

✔ = Primary outcome   (✔) = Secondary outcome

Polling Break

- Does your District have an established energy management plan?
  - Yes
  - No
  - I don't know

- Which of the following elements are covered in your District's energy management plan (select all that apply)?
  - Energy consumption (total and/or by fuel type)
  - Energy cost (total and/or by fuel type)
  - Renewable energy (onsite generation or offsite purchases)
  - Demand management/demand response
  - Energy procurement
  - We don't have an energy management plan
  - We have a plan, but I'm not sure what elements are included

Core Principles of Energy Management

Strategic Approach

- Instead of just…
  - Paying the bills as they come due
  - Focusing on annual budget cycles
  - Viewing facility operations as a cost center

- Energy management emphasizes…
  - Proactive planning
  - Multi-year point of view
  - Leveraging building-level improvements into organizational value (both financial and reputational)

Organizational Engagement

- Top-level commitment (e.g., superintendent, principals) sets the tone and helps secure buy-in from others.
- A broad and inclusive energy team should go beyond the facilities/engineering department to include representatives from the groups such as:
  - Teachers
  - Students
  - Janitorial staff
  - Food service staff
  - Finance department
  - Communications department
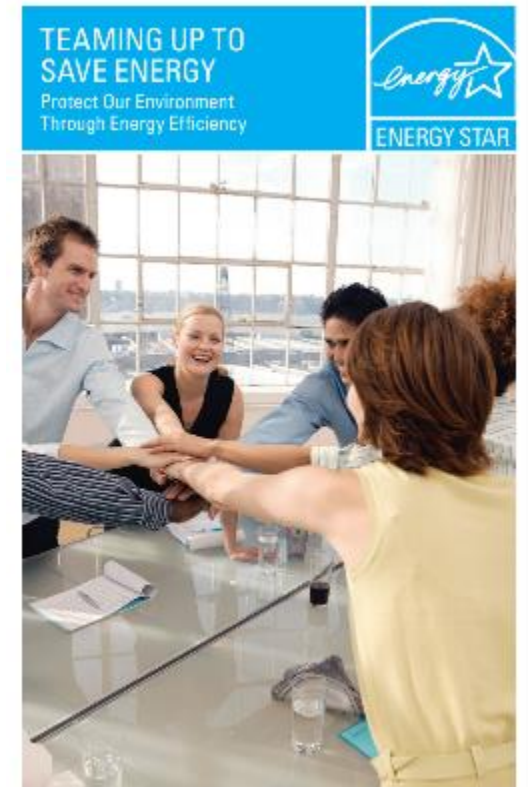
ENERGY STAR - Teaming Up to Save Energy

Whole-Building vs. System-Level Orientation

- Building systems do not operate in isolation; changes to one system may impact others.

- Whole-building focus allows the impact of O&M and behavioral measures to be captured, in addition to equipment-level improvements.

- Bundling measures at the whole-building level may help to improve project financials (measures with shorter paybacks can offset measures with longer paybacks)

Fundamental Building Science

Portfolio-Wide Assessment

- There will almost certainly be more projects identified than can be implemented in any given time period!

- Looking across a portfolio of properties enables prioritization and sequencing of projects, as well as further bundling opportunities to improve project financials.

- Not just a matter of identifying under-performing properties, but also an opportunity to identify superior performers and glean best practices that can be shared across the district.

- Opportunity for friendly competition among schools to drive improvements.

Importance of O&M

- Building design intent does not automatically result in building performance; sound operational practices required to achieve a building's potential.

- Last year's superior performance can become next year's average performance if insufficient attention is paid to O&M.

- "Quick wins" from no- and low-cost operational improvements can instill confidence in energy efficiency among decision makers.

Sequencing Upgrades

- Start small and build up.

- Emphasize the identification and elimination of unnecessary energy use before upgrading systems.
  - Especially important for key building systems that needs to be sized to the building load (e.g., boilers/furnaces, chillers, air distribution).
  - Critical if onsite renewable energy is part of your vision.

Stages of an integrated upgrade approach
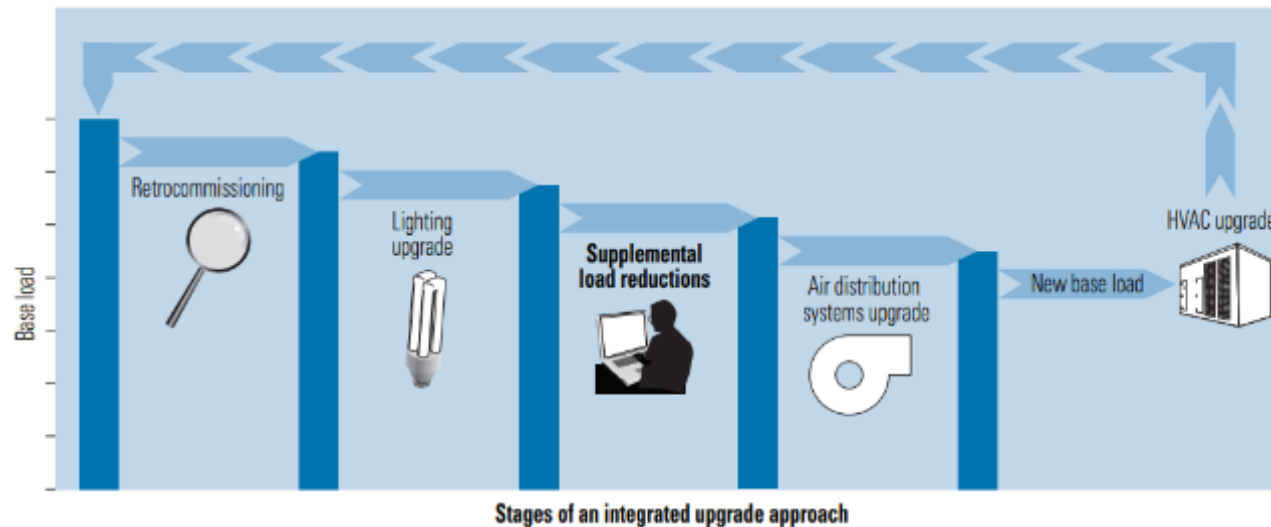
Source:
https://www.energystar.gov/sites/
default/files/buildings/tools/EPA_
BUM_Full.pdf

Emphasis on Continuous Improvement

- Individual projects may have a finish line, but energy management should be ongoing.

- Emphasizing improvement over absolute performance ensures that everyone can play a role in your success – from the oldest school in the district to the newest.

  - Not every building will be in a position to pursue or receive green building certification (e.g., ENERGY STAR, LEED), but all buildings can improve upon their prior year's performance.

  - Energy improvement – regardless of the baseline – means cost savings and emissions reductions.

Polling Break
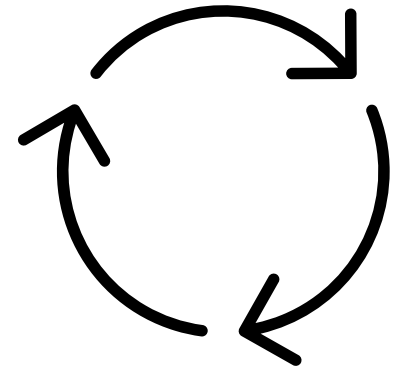
- Which of these principles of energy management were <u>not</u> already familiar to you (select all that apply):
    - Strategic approach
    - Organizational engagement
    - Whole-building focus
    - Portfolio-wide approach
    - Importance of O&M
    - Sequencing upgrades
    - Importance of continuous improvement

Frameworks for Energy Management

ENERGY STAR® Guidelines for Energy Management

Proven strategy based on actual practices of champion ENERGY STAR partners.

- Step 1: Make Commitment
- Step 2: Assess Performance
- Step 3: Set Goals
- Step 4: Create Action Plan
- Step 5: Implement Action Plan
- Step 6: Evaluate Progress
- Step 7: Recognize Achievements
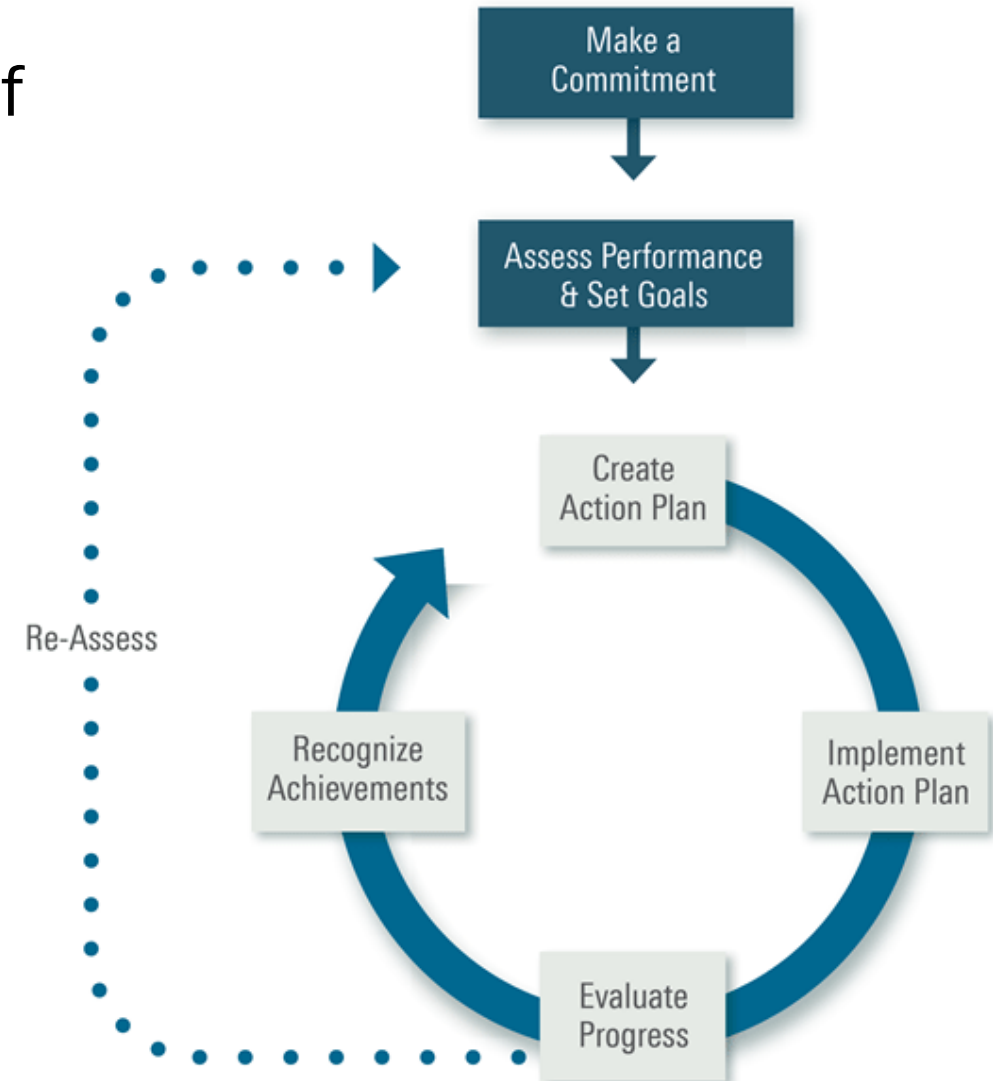
Source: https://www.energystar.gov/buildings/save_energy_commercial_buildings/comprehensive_energy_management

ENERGY STAR® Guidelines for Energy Management, cont'd.

1. **Make Commitment**
   - Appoint an energy director
   - Establish an energy team
   - Institute an energy policy

2. **Assess Performance**
   - Gather and track data
   - Establish baselines
   - Benchmark
   - Analyze data
   - Conduct technical assessments and audits

3. **Set Goals**
   - Determine scope
   - Estimate potential for improvement
   - Establish goals

4. **Create Action Plan**
   - Define technical steps and targets
   - Determine roles and resources

ENERGY STAR® Guidelines for Energy Management, cont'd.

6. Implement Action Plan
   - Create a communication plan
   - Raise awareness
   - Build capacity
   - Motivate
   - Track and monitor

7. Evaluate Progress
   - Measure results
   - Review action plan

8. Recognize Achievements
   - Provide internal recognition
   - Receive external recognition

Assess Your Energy Program Against the Guidelines

ENERGY STAR® Energy Management Assessment Matrix

	Little or no evidence	Some elements	Fully implemented	Next Steps
Make Commitment to Continuous Improvement				
Energy Director	No central or organizational resource Decentralized management	Central or organizational resource not empowered	Empowered central or organizational leader with senior management support	
Energy Team	No company energy network	Informal organization	Active cross-functional team guiding energy program	
Energy Policy	No formal policy	Referenced in environmental or other policies	Formal stand-alone EE policy endorsed by senior mgmt.	
Assess Performance and Opportunities				
Gather and Track Data	Little metering/no tracking	Local or partial metering/tracking/ reporting	All facilities report for central consolidation/analysis	
Normalize	Not addressed	Some unit measures or weather adjustments	All meaningful adjustments for organizational analysis	
Establish baselines	No baselines	Various facility-established	Standardized organizational base year and metric established	
Benchmark	Not addressed or only same site historical comparisons	Some internal comparisons among company sites	Regular internal & external comparisons & analyses	
Analyze	Not addressed	Some attempt to identify and correct spikes	Profiles identifying trends, peaks, valleys & causes	
Technical assessments and audits	Not conducted	Internal facility reviews	Reviews by multi-functional team of professionals	
Set Performance Goals				
Determine scope	No quantifiable goals	Short term facility goals or nominal corporate goals	Short & long term facility and corporate goals	
Estimate potential for improvement	No process in place	Specific projects based on limited vendor projections	Facility & organization defined based on experience	

Establish goals	Not addressed	Loosely defined or sporadically applied	Specific & quantifiable at various organizational levels	
Create Action Plan				
Define technical steps and targets	Not addressed	Facility-level consideration as opportunities occur	Detailed multi-level targets with timelines to close gaps	
Determine roles and resources	Not addressed or done on ad hoc basis	Informal interested person competes for funding	Internal/external roles defined & funding identified	
Implement Action Plan				
Create a communication plan	Not addressed	Tools targeted for some groups used occasionally	All stakeholders are addressed on regular basis	
Raise awareness	No promotion of energy efficiency	Periodic references to energy initiatives	All levels of organization support energy goals	
Build capacity	Indirect training only	Some training for key individuals	Broad training/certification in technology & best practices	
Motivate	No or occasional contact with energy users and staff	Threats for non-performance or periodic reminders	Recognition, financial & performance incentives	
Track and monitor	No system for monitoring progress	Annual reviews by facilities	Regular reviews & updates of centralized system	
Evaluate Progress				
Measure results	No reviews	Historical comparisons	Compare usage & costs vs. goals, plans, competitors	
Review action plan	No reviews	Informal check on progress	Revise plan based on results, feedback & business factors	
Recognize Achievements				
Provide internal recognition	Not addressed	Identify successful projects	Acknowledge contributions of individuals, teams, facilities	
Get external recognition	Not sought	Incidental or vendor acknowledgement	Government/third party highlighting achievements	

https://www.energystar.gov/buildings/tools-and-resources/energy-program-assessment-matrix-excel

Assess Your Facility Using the Guidelines Framework

ENERGY STAR® Facility Energy Management Assessment Matrix

DOE's 50001 Ready Program

"A self-guided approach for facilities to establish an energy management system and self-attest to the structure of ISO 50001, a voluntary global standard for energy management systems in industrial, commercial, and institutional facilities."

DOE offers recognition for organizations that:

- Complete all tasks in the 50001 Ready Navigator
- Self-attest to the completion of these tasks
- Measure and improve energy performance over time

50001 Ready Navigator

- Based on the structure of ISO 50001

- 25 required tasks, each with supporting guidance:

  - Context of the Organization (tasks 1-3)

  - Leadership (tasks 4-6)

  - Planning (tasks 7-13)

  - Support (tasks 14-16)

  - Operation (tasks 17-19)

  - Performance Evaluation (tasks 20-23)

  - Improvement (tasks 24-25)

- Full list of tasks available at https://navigator.lbl.gov/task-index.

- Access guidance documents and tracking worksheets for offline use via the 50001 Ready Playbook

Example View of the 50001 Ready Navigator Interface

Example View of the 50001 Ready Navigator Interface

Examples of School Districts Using the 50001 Ready Framework

- [Boise, ID](#)
- [Jerome, ID](#)
- [Nampa, ID](#)
- [Wendell, ID](#)

Polling Break

- Is your District using any of the following frameworks as a foundation for energy management efforts?
    - ENERGY STAR Guidelines
    - 50001 Ready Navigator
    - Other (please note)

Other Key Resources

Better Buildings Solution Center: K-12 Schools

https://betterbuildingssolutioncenter.energy.gov/sectors/k-12-school-districts

DOE/LBNL Efficient and Healthy Schools

https://efficienthealthyschools.lbl.gov/

Questions?

We look forward to working with you!