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Desktop Audits: Overview, Case Studies, Guidance
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Agenda

- EISA Audit Requirements

- Basic Remote Audit
  - Statement of Work
  - Case Study
  - Comparison of Tools

- Guidance/resources

Background

- Energy Independence and Security Act (EISA) of 2007 requires that federal agencies audit 25% of their 3.1 billion square feet (ft^2) of covered facilities each year.[1]

- Several newer, advanced options such as monitoring-based commissioning, fault detection and diagnostics, and energy management systems can help support data collection and analysis to be used for EISA compliance.

- FEMP's Audit Decision Tree, Audit Definitions, and FEMP Guidance can be used by Agencies to determine the best approaches to evaluate their facilities.

- FEMP continues to develop additional resources to support agencies in meeting EISA compliance:
  - Template statements of work to procure audit services

1. https://www.gpo.gov/fdsys/pkg/BILLS-110hr6enr/pdf/BILLS-110hr6enr.pdf

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Audit Template Statements of Work (SOW)

- Desk Audit

- Basic On-site Audit

- Available soon on FEMP Audit Program website:
  - https://www.energy.gov/eere/femp/energy-and-water-audits-federal-buildings

Desk Audit Scope

Desk Audit

An evaluation that identifies and analyzes energy and water measures from building information/data and records _obtained without an onsite visit_.

- combines inputs from benchmarking tools, such as EPA Portfolio Manager and/or DOE Building Asset Score, and previous EISA audits to assess previously recommended conservation measures yet to be implemented, identify available ECMs, WCMs, and renewable energy measures, estimate energy, water, and cost savings / economics, and generate an EISA-compliant audit report. The evaluation of measures can be completed using engineering calculations, building energy models, or other methods stipulated by the requesting entity.

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Desk Audit

- Scope (completed without visiting site):
  - review of facility performance and previous audit reports
  - identification of available measures
  - meet federal energy and water evaluation goals without performing an on-site audit.

- The Desk Audit will evaluate the life cycle costs of efficiency conservation measures for energy, water, building controls, and renewable energy.

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Task 1

- **Review Historical Facility Data and Preliminary Energy and Water Use Analysis (Benchmarking)**

  - *Task 1.1 Review Historical Utility Data and Utility Rate Analysis*

  - *Task 1.2 Preliminary Energy and Water Use Analysis (Benchmarking)*

  - *Task 1.3 Review Previous Energy and Water Audits and Interview Facilities Staff*

Task 2

- **Desk Audit Measure Identification and Economic Analysis**

  - *Task 2.1 Analysis of Recommended Measures from Past Audit Reports*

  - *Task 2.2 Identification of New Measures from Present Facility Conditions*

Task 3

- **Reporting and Deliverables**

  - *Task 3.1 Desk Audit Report*

  - *Task 3.2 Analysis Tools*

Desk Audit
Case Study

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Background

- Problem: Over 600 EISA audits needed, but only 12 percent complete

- Agency identified 260 very similar facilities

- FEMP and Agency agreed to work together:
  - Provide on-site audits for a sample of the 260
  - Develop a method to do off-site desk audits for remainder
  - Provide list of low-cost or no-cost efficiency measures

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Desk Audits Supplement On-Site Audits

- A total of 236 EISA audits completed (both desk and in-person)
  - Identified a sub-set of 26 representative sites and conducted on-site audits
  - The remainder of the sites were analyzed using desk audits. These sites were identified as high potential sites for desk audits because of the similarities between the selected sites

- Increased compliance from 12.7% to 45.8%

- Site selection for on-site audits based on the buildings' similarities with other sites and across climate zones.
  - The goal was to visit sites that would allow for the extrapolation of findings across all similar sites.

- Through utility bill normalization, the conservation measures at the desk audit sites were predicted with a high level of confidence.

Desk Audit Methodology

The desk audits were performed using the following methodology:

1. Organize data from site visit energy audits into a database. Use the findings to develop a range of energy savings by energy conservation measure category.

2. Normalize the energy savings for each energy conservation measure category by site utility consumption.

3. Collect utility data from the various sites which included: electricity usage, electricity demand, cost for use, and cost for demand. The sites with the highest utility rates were used to determine which sites to be prioritized for ECM implementation.

4. Questionnaires were sent to each of the facility managers to fill out. A subset of the facilities filled out questionnaires that are Excel based.

5. ECMs were spot checked to determine applicability based on the questionnaire responses.

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ECM Findings

	Lighting	Desktop to Laptop	CRT Monitors	HVAC eff. improvement	Cogged V-belts	Enable Economizer	UPS Efficiency	HE Motors	HVAC Optimization	Zone Setpoint Reduction	**Other Improvements
Times Encountered (# of sites)	25	8	10	22	6	7	15	14	17	10	2 to 5
Percentage	96%	31%	38%	85%	23%	27%	58%	54%	65%	38%	8 to 19%

**Other improvements include zone temperature, insulating ducts,
CV to VAV, indirect evaporative cooling and envelope improvements.

Potential Cost Savings through ECMs at all ASRs/ARSRs

- Annual cost savings: $1,387,000/year (from utility bills)
- Implementation cost: $3,978,000
- Payback period: 2.9 years

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Key Findings

- Costs:

  - Effort was funded at $300k

  - Extrapolating out the cost of the 26 site visits audits to all 236 audited sites would have cost approximately $1,815,000. This would have resulted in a cost intensity of $2.63/ft^2. The total cost intensity for the FEMP effort came out at $0.44/ft^2 including desk audits and site visit audits.

- Economics:

  - Annual cost savings $1,387,000/year
  - Implementation cost $3,978,000
  - Payback period 2.9 years

- Energy Intensity Reduction:

  - Average site EUI of 216 kBtu/ft^2
  - ECM savings found during the audits = 18% (would bring EUI down to 178 kBtu/ft^2)

Lessons Learned

1. Whenever data collection activities are taking place, expect that the data collection effort will take much more time than anticipated.

2. Build in some time to do processing and QA on data once it comes in. Also set a realistic goal for the threshold of data to successfully be collected (i.e., won't get 100% data).

3. Don't forget water and renewables!

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Desk Audit
Tool Comparison

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ASHRAE Task Comparison

ASHRAE Process and Reporting Tasks versus Various Alternative Audit Products[3]

ASHRAE Process Tasks	Level 1 Audit	Level 2 Audit	Level 3 Audit	Tool 1	Tool 2	Tool 3	Tool 4	Tool 5	Tool 6	Tool 7	Tool 8
Conduct preliminary energy analysis (PEA)	X	X	X		X	X	X		X	X	X
Conduct walk through survey	X	X	X	X	X	X	X	X	X		
Identify low-cost/no-cost recommendations	X	X	X	X	X		X		X	X	X
Identify capital improvements	X	X	X	X	X	X	X			X	X
Review mech.and elec.(M&E) design & condition & O&M practices		X	X	X	X		X	X		X	X
Measure key parameters		X	X			X	X	X		X	
Analyze capital measures (savings and costs, including interactions)		X	X	X		X	X			X	X
Meet with owner/operators to review recommendations		X	X	X		X	X	X	X	X	X
Conduct additional testing/monitoring			X							X	
Perform detailed system modeling			X		X		X			X	X
Provide schematic layouts for recommendations			X		X						

ASHRAE Reporting Tasks	Level 1 Audit	Level 2 Audit	Level 3 Audit	Tool 1	Tool 2	Tool 3	Tool 4	Tool 5	Tool 6	Tool 7	Tool 8
Estimate savings from utility rate change	X	X	X				X		X	X	
Compare EUI to EUIs of similar sites	X	X	X				X		X	X	X
Summarize utility data	X	X	X			X	X		X	X	X
Estimate savings if EUI were to meet target	X	X	X						X	X	X
Estimate low-cost/no-cost savings		X	X	X			X		X	X	X
Calculate detailed end-use breakdown		X	X				X			X	X
Estimate capital project costs and savings		X	X	X		X	X			X	
Complete building description and equipment inventory		X	X		X	X		X		X	
Document general description of considered measures		X	X	X	X	X	X	X		X	
Recommend measurement and verification (M&V) method		X	X								
Perform financial analysis of recommended EEMs		X	X	X		X	X		X	X	X
Write detailed description of recommended measures			X	X		X	X		X	X	X
Compile detailed EEM cost estimates			X	X		X	X			X	X

Remember, for an EISA audit:
ASHRAE Level 1 + Water + RE + LCCA
ASHRAE Level 2 + Water
ASHRAE Level 3 + Water

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Other Considerations

- Not every product is appropriate for every agency or every building
  - For example, some require 15-minute interval data
- Costs need to be appropriate for savings potential
- Some products' time and cost investments may not be realized until second audit on a building
- Understand which measures a product considers

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In Closing

- Proceed pragmatically when considering alternative audit approaches:
  - Very new, fluid market
  - Products and companies rapidly entering and exiting the marketplace
  - Pilot an array of products to determine which are best for your agency
  - Look for published, third-party reviews of products
  - Look for related guidance, webinars, resources, and training from FEMP: https://www.energy.gov/eere/femp/federal-energy-management-program

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