FEMP First Thursday Seminars

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Competency Development
After completing this seminar the learner will be able to:

1. Manage an Energy Efficiency Expert Evaluation in a Federal facility to:
   - improve energy efficiency
   - monitor and evaluate the performance of critical building systems
   - employ trouble-shooting techniques to identify efficiency opportunities on an equipment-wide and systems-wide basis
   - identify low- and no-cost Energy Conservation Opportunities (ECOs) or Energy Conservation Measures (ECMs)
   - provide justification for capital improvements by identifying ECOs/ECMs, including life cycle cost analyses
   - increase occupant comfort and satisfaction by resolving issues
Competency Development

After completing this seminar the learner will be able to:

2. Uncover root causes of problems and develop practical solutions for facility energy and water efficiency improvements.

3. Employ strategies from Energy Assessments, Building Re-commissioning, and Re-tuning to:
   – immediately improve energy efficiency
   – determine the need for more in-depth evaluations such as re-commissioning
   – determine the need for capital improvements and provide cost information for life cycle costing

What is an Energy Efficiency Expert Evaluation?
Energy Efficiency Expert Evaluations

• Comprehensive, multi-disciplinary approach
• Team of energy experts and facility staff
• Neutral and unbiased review
• Focused on root causes rather than symptoms
• Common sense philosophy

Goals

- Increase energy and water efficiency
- Improve operational efficiency and system performance
- Achieve cost savings

Results

- No-cost and Low-cost improvements
- Prioritized list of Energy Conservation Measures (ECMs) with cost justifications
- Final report with justification for additional/alternative project funding
Laws and Regulations

**EISA 2007 –Sec. 432**

Mandates that Federal facilities decrease energy intensity by *3% per fiscal year (FY)* relative to a 2003 baseline.

Requires agencies to conduct energy assessments on **25% of covered facilities each year**.

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Energy Efficiency Expert Evaluations and EISA 2007 Sec. 432

**Does process meet audit goals required by EISA 2007 Sec. 432?**

The assessment meets the requirements by:

1. Providing the walk-through audit with results (ECOs) in a written report
2. Precluding the need for a full commissioning if the root problems are minor and can be corrected “on the spot” during the evaluation

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**Combines Most Practical Elements of Energy Assessment/Audit Retro-commissioning**

**Audits**
Comprehensive look at entire building such as envelope, elevators, lighting, etc.

**Energy Efficiency Expert Evaluation**

**Retro-commissioning**
Generally equipment-focused looking at design intent and outputs Focus on low- and no-cost outcomes

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**Three Options for Evaluation**

<table>
<thead>
<tr>
<th>With internal on-site staff</th>
<th>With outside experts/consultants</th>
<th>With agency “sister facility”</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Advantages:</strong></td>
<td><strong>Advantages:</strong></td>
<td><strong>Advantages:</strong></td>
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<tr>
<td>- Low cost</td>
<td>- New ideas</td>
<td>- Low cost</td>
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<tr>
<td>- Logistics</td>
<td>- Special expertise</td>
<td>- Logistics</td>
</tr>
<tr>
<td>- Staff knowledge</td>
<td>- Additional personnel</td>
<td>- Staff knowledge</td>
</tr>
<tr>
<td>- History</td>
<td>- Higher cost</td>
<td>- History</td>
</tr>
<tr>
<td><strong>Disadvantages:</strong></td>
<td>- No historical knowledge of</td>
<td>- New ideas</td>
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<tr>
<td>- Too close</td>
<td>buildings or equipment</td>
<td>- Special expertise</td>
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<tr>
<td>- Lack of objectivity</td>
<td></td>
<td>- Additional personnel</td>
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<tr>
<td>- Fear of reprisal</td>
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<tr>
<td>- Interruptions</td>
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Four Phases

Planning

Discovery

Correction

Hand-off

What happens in the Planning Phase?
Identify Site Needs and Goals

Meet key management performance goals for:

- Operational improvement
- Energy and water savings
- Indoor environmental quality
- Environmental impacts
- Maintainability and sustainability

Develop Project Objectives

Focus on low-cost, no-cost solutions

Priority focus on reducing energy use intensity

Define metrics to evaluate progress/results and update

Justify ESPCs, UESCs, PPAs
Create a Multi-Disciplinary Team

Energy Experts and Facility Staff
- Contract for expertise as needed
- Develop a sister facility approach
- Use in-house staff with facility knowledge and access as experts

Bring in building occupants at appropriate times

Examples of Key Team Member Roles

- O&M Staff
- Facilities/Energy Management
- Employees
- Engineers
- E4 Team "Outsiders"
- Building Occupants
Pre-Visit Questionnaire
Completed by facility owners, O&M staff

Gathers information on:
- Facility basic information
  - e.g., building age, square footage, equipment
- Utility Data
- Perception of biggest issues
  - e.g., hot and cold spots, increase in utility bills, etc.

Study of Key Documentation
- Utility bills
- Other baseline data
  - Energy use intensity
  - Metered data
- A&E drawings
- Equipment inventory
- O&M manuals
- Building history and potential mission changes
- Space changes
Planning Phase in Review

At the end of the Planning Phase:
- Objectives and metrics are determined
- Team is assembled
- Documentation is analyzed
- Missing documentation is identified
- Questionnaire is completed

What are the primary activities in the Discovery Phase?
Discovery Phase is On-Site

**Generally, an intensive 2 - 4 day fact-finding event**

- Kick-off meeting for data gathering and establishing consensus
- Training
- “Windshield Tour”
- Required diagnostics and problems identified and studied

Discovery Phase Goals

- Uncover the root causes of energy waste
- Move from problem identification to solution
- In depth investigation along with diagnostic and functional testing and analysis
- Identifies no/low cost (and other) opportunities for both energy savings and system effectiveness
### Key Areas for Discovery

<table>
<thead>
<tr>
<th>Facility Design</th>
<th>Installation</th>
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<tbody>
<tr>
<td>• Building mission changes</td>
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<tr>
<td>• Floor plan changes</td>
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<tr>
<td>• Energy saving control strategies missed in design</td>
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<tr>
<td>• System upgrades that miss the mark</td>
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<td>• Antiquated systems that don’t work well</td>
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<td>• Control systems negated by</td>
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<tr>
<td>• Non-functioning equipment</td>
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<tr>
<td>• Bypass functions</td>
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<td>• Overridden functions</td>
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<table>
<thead>
<tr>
<th>Operations</th>
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<tbody>
<tr>
<td>• Changes in system configurations require new control sequences</td>
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<tr>
<td>• Check for conflicts in operating sequences</td>
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<table>
<thead>
<tr>
<th>Maintenance</th>
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<tbody>
<tr>
<td>Software Maintenance</td>
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<tr>
<td>• Service updates</td>
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<tr>
<td>• Software revisions</td>
</tr>
<tr>
<td>Hardware Maintenance</td>
</tr>
<tr>
<td>• Undisturbed operation</td>
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<tr>
<td>• Designed operating environment</td>
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<table>
<thead>
<tr>
<th>Culture</th>
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<tr>
<td>• Workforce culture</td>
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<tr>
<td>• The organization’s institutional values</td>
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### Kick-Off Meeting

**May be the most important part of the process**

- Formally introduces team and purpose
- Site staff participating in meeting
  - Building managers
  - Facility managers
  - Energy manager
  - Technicians
  - Occupants
- Use completed questionnaire to probe and get multiple perspectives on issues
Technical Training for Facility Staff

- **Customized** based on needs of facility and staff
- **New practices** that will improve efficiency
- **Best practices** of audits and retro-commissioning
- **Replicates success of other sites**
- **Preventative and predictive** maintenance practices
- **Goal is that facility staff can then train others**
  - become a “sister facility” for further expert evaluations

Staff Training Agenda

- Energy Usage Analyses
- Operating Schedules
- Methods to Identify Root Problems
- New Operations
- Roles and Responsibilities
- Recognition
Train the Trainer

- Goal is that facility staff can then train others in their agency
- Become a “sister facility” for further expert evaluations
- Establish a legacy of well-qualified personnel

On-site Walk-through -- “Windshield Tour”

Get an overall feel for the facility:
- Building uses
- Occupancy patterns
- Age and efficiency of equipment
- Equipment O&M practices
- Observing and talking with occupants

Develop key areas for further study
“Windshield Tour” – An Opportunity for Team-Building

Establish a “no-fault” policy

- Work with staff to accommodate their schedules and routines
- Maintain a non-judgmental attitude
- Respect privacy and anonymity

Active Listening

Key elements and importance of intentional listening:

- Staff should not see the process as a “gotcha!”
- Whole team stays together to listen as a group
- Staff will need to “own” solutions
- Questions are asked from multi-technical perspectives
- Continue asking probing questions until the most likely root causes are determined
Personnel Interviews

- Interviews allow staff to explain what’s really happening
- Group interviews build off a range of perspectives
- Individual interviews allow people to “open up”
- Experienced personnel identify historical problems

After-Tour: In-depth Inspection and Interviews

- Based on results of the kickoff meeting and “windshield tour”
- Employ diagnostics as needed (e.g. “thermography, etc.)
- Check gauges and controls
- Examine equipment, take measurements, log data
- Inspect building systems
Walk-through Best Practices

During the facility Walk-through, be sure to:

• Talk to staff about building history/changes
• Be observant, use all of your senses
• Read gauges and indicators carefully

Schedule tours during unoccupied or off-peak hours

Now... Let’s walk around YOUR Facility....

Telltale Signs on a Walk-Through
Telltale Signs on a Walk-Through
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Telltale Signs on a Walk-Through

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Telltale Signs on a Walk-Through

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Preparation for the Out-brief

• Analyze findings from workshops and inspections
• Brainstorm solutions
• Develop preliminary list of ECMs

The Out-brief

The Out-brief includes:
- Original facility team
- Senior management
- Other participants/stakeholders

Be sure to:
- Recognize and celebrate “champions”
- Acknowledge/praise good practices found
- Clearly articulate/list preliminary findings
The Discovery Phase in Review

- On site kick-off meeting identifies problems for further study
- “Windshield Tour” identifies good practices and problem areas
- Issues studied in detail to uncover root causes
- Preliminary findings presented and discussed in out-brief

What does the Correction Phase Involve?
The Correction Phase

Purpose

- Implement improvements based on Prioritized List of Findings
- Verify that corrections are based on root causes
- Establish measurement and verification (M&V) plan

In-Depth Analysis

- Review all documentation in detail
- Review findings made during inspection
- Perform cost analyses of potential solutions
Develop a Prioritized List of ECMs

- Determine low- and no-cost ECMs for immediate correction
- Document simple payback of ECMs requiring capital investments
- Prioritize ECMs based on greatest payback

Site Begins No-Cost Corrections

Outside team members should not make corrections or adjust equipment. Only site personnel should do this.

Site personnel can implement no-cost recommendations during walk-through or while awaiting final report.
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Results of the Correction Phase

- In depth review of all documentation and findings
- ECMs identified, costs-analyzed, and prioritized
- Site begins no-cost, low-cost solutions
- M&V plan established

What does the Hand-off Phase Involve?

FINAL REPORT

- Executive Summary
- Project Background Information
- Major Systems Equipment Inventory
- Data and Analysis Detail
- Energy Conservation Measures
The Hand-Off Phase includes:

- Update facility and systems documentation
- Revise O&M manuals and checklists
- Prioritize a Master List of Findings Report
- Develop and Submit a Final Report
- Check in 6 - 12 months

Update Facility System Documentation

- Update O&M Manuals
- Develop new/updated equipment checklists
- Revisit/revise preventative maintenance routines
- Draft a Re-commissioning plan
Elements of the Final Report

Organized to understand and concentrate implementation efforts

Documents the evaluation process and recommendations in 5 parts:

- Executive Summary
- Project Background Information
- Major Systems Equipment Inventory
- Data and Analysis Detail
- Energy Conservation Measures

Appendix A and B – Calculations, Assumptions, References

Final Report: Executive Summary

Prepare a succinct overview for senior management

Include a Final list of major ECMs

- Place ECMs in prioritized order
  - Savings
  - Estimated energy cost savings
  - Cost of the ECM
  - Simple payback
How Final Report Is Used

• As a general guidance document for future efforts
• As a precursor for a more in-depth analysis
• As basis for an ESPC, UESC, or capital project
• As a “ready to go” analysis for new projects

Follow Up: Six Month and One-Year

• Has the site implemented all no-cost recommendations?
• Has the site achieved expected results from prioritized ECMs?
• Has the training continued?
• Has the final report been used to justify additional project funding?
• Is the site serving as a “sister facility” for others?
Summary of Hand-off Phase

The Hand-off Phase includes:

- Staff training
- System documentation and updated procedures
- Final Report
- 6-12 month check

Seminar Summary

- Proven process for effective results
- Common sense solutions
  - finding root causes
  - correcting the problems
  - implementing low- and no-cost solutions
  - cost analysis of recommendations involving capital improvements
- Sharing the process, successes, and opportunities across the agency
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Resources

FEMP O&M Best Practices Guide 3.0 (Chapter 7)
www1.eere.energy.gov/femp/pdfs/omguide_complete.pdf

Online courses - Earn CEUs
www.femp.energy.gov/training

FEMP First Thursday Seminars
- Operations, Maintenance, and Commissioning
- Implementing Deep Retrofits: A Whole Building Approach
- Re-Thinking Operations & Maintenance for High Performance Buildings

eTraining
- Commissioning for Existing Federal Buildings
- Planning an Energy Assessment for Federal Facilities

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Resources

Department of Energy: Building Technologies Program

Federal Energy Efficiency:
http://energy.gov/eere/efficiency/government-energy-management

Retuning for Commercial Buildings Training
http://www1.eere.energy.gov/analysis/eii_index.html

Pacific Northwest National Laboratory

Retuning Commercial Buildings Training:
http://buildingretuning.pnnl.gov/
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