

Federal Energy Management Program

U.S. DEPARTMENT OF **ENERGY** | Energy Efficiency & Renewable Energy

**FEMP FIRST THURSDAY SEMIN@RS**  
What you need to know...online, live, and anytime.

**Energy Efficiency Expert Evaluations**

Instructor: Ed St. Germain  
Enviro-Management and Research, Inc. (EMR)

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Federal Energy Management Program

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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

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### 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 and Results

### Goals

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

### Results

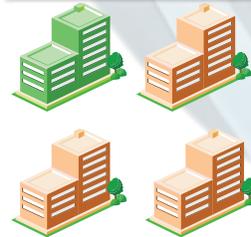
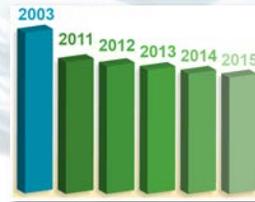
- No-cost and Low-cost improvements
- Prioritized list of Energy Conservation Measures (ECMs) with cost justifications
- Final report with justification for additional/alternative project funding

## 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**



## 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

<http://energy.gov/eere/femp/downloads/facility-energy-management-guidelines-and-criteria-energy-and-water-evaluations>

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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

<b>With internal on-site staff</b>	<b>With outside experts/consultants</b>	<b>With agency "sister facility"</b>
<p><b>Advantages:</b></p> <ul style="list-style-type: none"> <li>- Low cost</li> <li>- Logistics</li> <li>- Staff knowledge</li> <li>- History</li> </ul> <p><b>Disadvantages</b></p> <ul style="list-style-type: none"> <li>- Too close</li> <li>- Lack of objectivity</li> <li>- Fear of reprisal</li> <li>- Interruptions</li> </ul>	<p><b>Advantages:</b></p> <ul style="list-style-type: none"> <li>- New ideas</li> <li>- Special expertise</li> <li>- Additional personnel</li> </ul> <p><b>Disadvantages</b></p> <ul style="list-style-type: none"> <li>- Higher cost</li> <li>- No historical knowledge of buildings or equipment</li> </ul>	<p><b>Advantages:</b></p> <ul style="list-style-type: none"> <li>- Low cost</li> <li>- Logistics</li> <li>- Staff knowledge</li> <li>- History</li> <li>- New ideas</li> <li>- Special expertise</li> <li>- Additional personnel</li> </ul>

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### Four Phases

**Planning**

**Discovery**

**Correction**

**Hand-off**

- 1. The Executive Summary
- 2. Project Background Information
- 3. Major Systems Equipment Inventory
- 4. Data and Analysis Detail
- 5. Energy Conservation Opportunities

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## *What happens in the Planning Phase?*

The image shows two men in a meeting room. One man, wearing a dark shirt, is standing and looking at a large map or blueprint on the wall. The other man, wearing a light-colored shirt, is pointing at a specific area on the map. They appear to be in a collaborative discussion.

## 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 as experts



#### Bring in building occupants at appropriate times

### Examples of Key Team Member Roles



## Pre-Visit Questionnaire

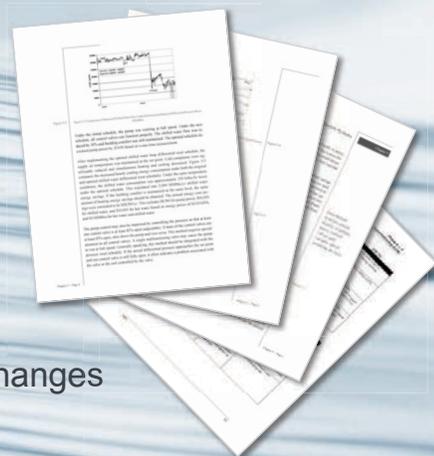
Completed by facility owners, O&M staff

### 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



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## Key Areas for Discovery

- Facility Design**
  - Building mission changes
  - Floor plan changes
  - Energy saving control strategies missed in design
  - System upgrades that miss the mark
- Installation**
  - Antiquated systems that don't work well
  - Control systems negated by
    - Non-functioning equipment
    - Bypass functions
    - Overridden functions
- Operations**
  - Changes in system configurations require new control sequences
  - Check for conflicts in operating sequences
- Maintenance**
  - Software Maintenance
    - Service updates
    - Software revisions
  - Hardware Maintenance
    - Undisturbed operation
    - Designed operating environment
- Culture**
  - Workforce culture
  - The organization's institutional values

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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

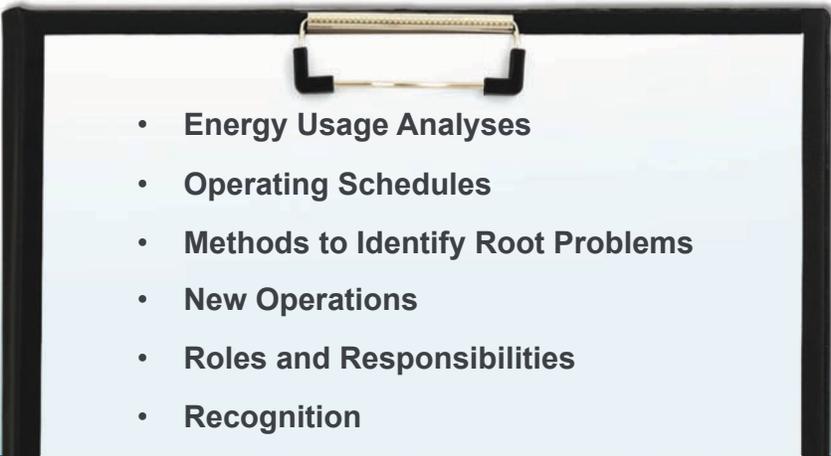


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### Technical Training for Facility Staff

- **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



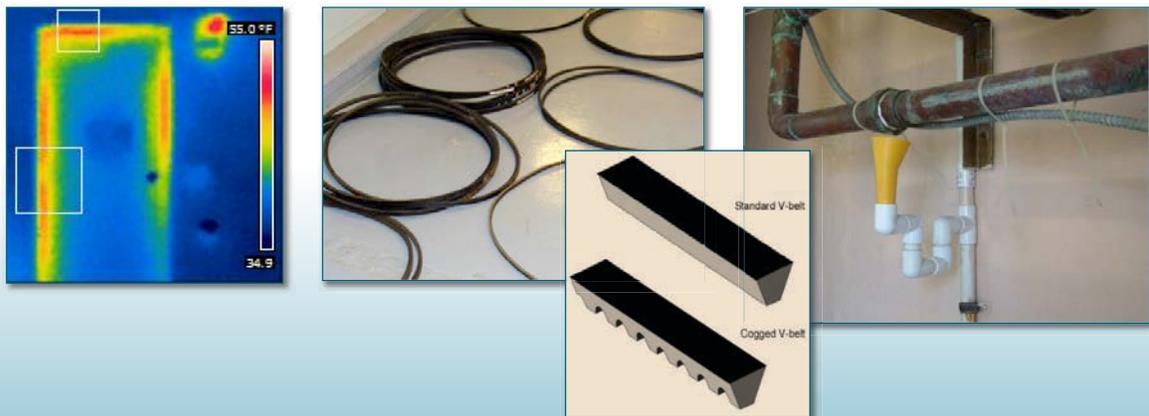
### Telltale Signs on a Walk-Through



### Telltale Signs on a Walk-Through



### Telltale Signs on a Walk-Through



### 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



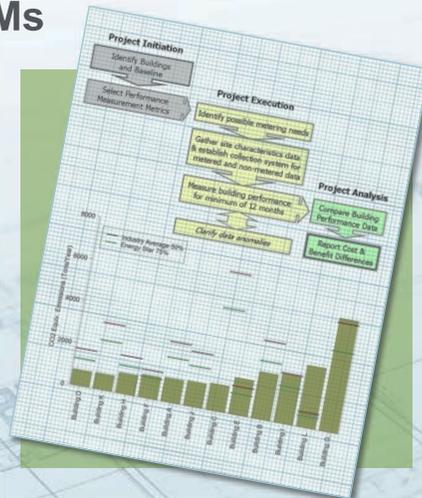
## In-Depth Analysis

- 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.



## 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?*



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**The Hand-Off Phase includes:**

```

graph TD
    A[Develop and Submit a Final Report] --> B[Check in 6 - 12 months]
    B --> C[Update facility and systems documentation]
    C --> D[Revise O&M manuals and checklists]
    D --> E[Prioritize a Master List of Findings Report]
    E --> A
  
```

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**Update Facility System Documentation**

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

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## 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



## Resources

### FEMP O&M Best Practices Guide 3.0 (Chapter 7)

[www1.eere.energy.gov/femp/pdfs/omguide\\_complete.pdf](http://www1.eere.energy.gov/femp/pdfs/omguide_complete.pdf)

### Online courses - Earn CEUs

[www.femp.energy.gov/training](http://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

## 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](http://www1.eere.energy.gov/analysis/eii_index.html)

### Pacific Northwest National Laboratory

Retuning Commercial Buildings Training:

<http://buildingretuning.pnnl.gov/>

## Contacts

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