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

The Energy Audit Process & State Applications

May 23rd, 2013

DOE's State and Local Technical Assistance Program

DOE's Technical Assistance Program

Priority Area: EE & RE Technologies

- **Peer exchange & trainings**
  - *Past audit-related webinars* on the Solution Center and FEMP website
  - *Upcoming webinars* focused on technical topics and their state-specific applications
  - Attend upcoming *DOE State and Local Communities Summit, May 30-31st*, in Washington, DC
- **Resources**
  - Buildings Technology Office and Federal Energy Management Program websites
  - Improved *Solution Center* portal for technology resources live later this year
- Apply for **one-on-one assistance** and **peer matching**

How to Tap into These and Other TAP Offerings

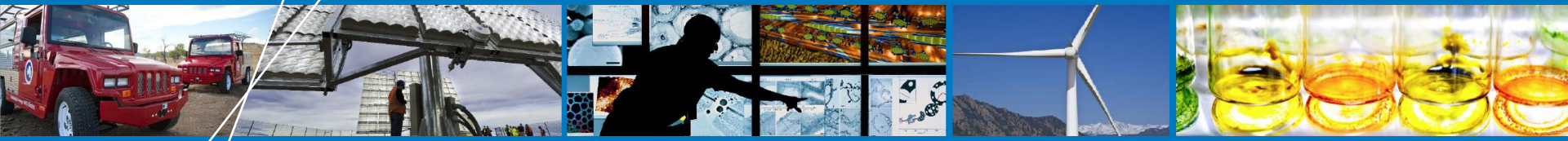
- Visit the ***Solution Center***
  www.eere.energy.gov/wip/solutioncenter/

- Submit an ***application*** for assistance
  www.eere.energy.gov/wip/solutioncenter/technical_assistance.html

- Sign up for ***TAP Alerts***, the TAP mailing list, for updates on our latest and greatest
  TechnicalAssistanceProgram@ee.doe.gov

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Energy Assessments



Tap Webinar Series

Lars Lisell

May 23, 2013

Audit process

Main Objective: Identify opportunities to reduce energy consumption and cost

Equally Important: Provide information to owner/operator to decide which recommendations to implement

- **Typical steps:**

Pre-Audit

- Collect/analyze historical energy use data
- Study building and operating trends

Audit

- Collect building information and consult with staff/occupants
- Identify potential modifications to reduce energy and cost

Post-Audit

- Perform engineering and economic analysis
- Prepare a prioritized list of recommendations
- Report results

Make sure the process has value

- **Bring the team together**
  - Facility manager
  - Energy manager
  - Decision maker who can fund projects
  - Project champion
  - Building engineer
  - Energy auditor
  - Utility representatives
  - Controls contractor
- **Team activities**
  - Kickoff meeting
  - Close-out meeting
  - Report review
  - Implementation pathway brainstorm
  - Consensus building

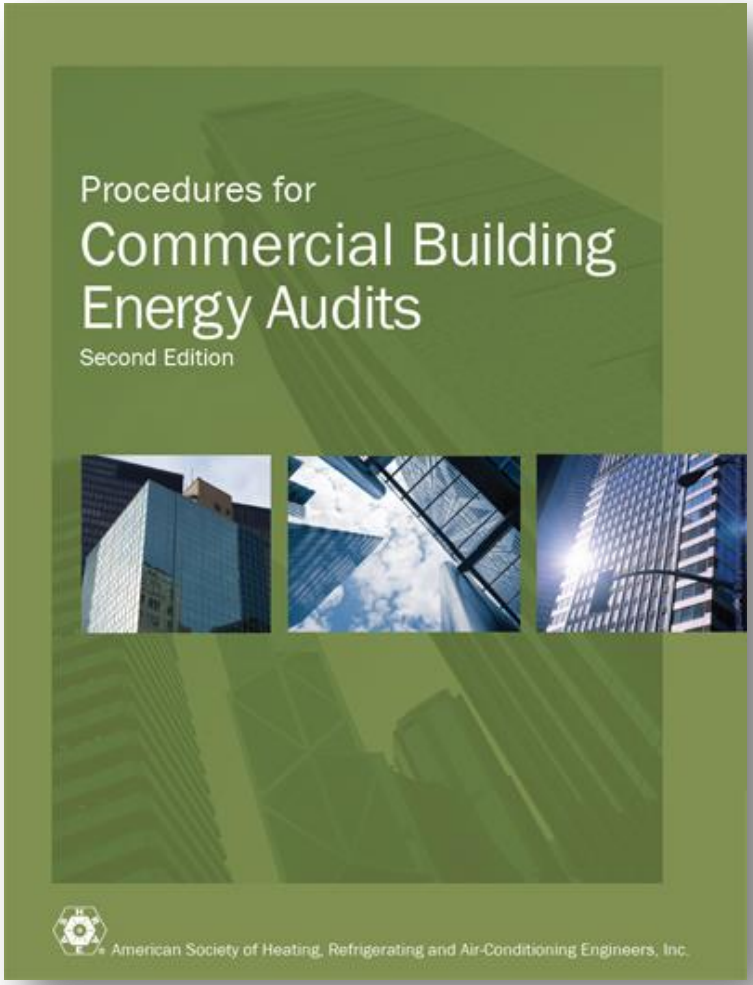
Picking a good energy auditor

- ASHRAE BEAP – Building Energy Assessment Professional, requires experience and passing an exam. Requires continuing education units (CEU) to maintain.
- AEE CEA – Certified Energy Auditor, requires experience, a seminar, and passing an exam. Requires CEU to maintain.
- Ask for a sample audit report, call references, look at how much experience the auditor has, and how much experience the company has. Send out a request for quotation (RFQ).
- Contact utility for list of approved contractors
- Leverage the latest auditing technology

simuwatt
a concept3D product

ASHRAE audit level definitions

- Level 1: Walk-through analysis
- Level 2: Energy survey and analysis
- Level 3: Detailed analysis of capital-intensive modifications



Typical costs for energy assessments

Level 1

- $\$0.03/ft^2$ - $\$0.10/ft^2$

Level 2

- $\$0.11/ft^2$ - $\$0.25/ft^2$

Level 3

- $\$0.26/ft^2$ - $\$0.70/ft^2$

- These are audit costs that we have seen for state and federal government audits, but building complexity, size of facility, and distance auditor has to travel all affect final costs.

Level 1: Walk-through analysis

- **Assess building's current energy cost and efficiency**
  - Utility bill analysis
  - Brief survey of building
- **Identify no-cost/low-cost measures**
- **Identify capital improvements that merit further consideration**
- **Conduct an initial estimate of cost and savings**
  - Hand calculations
  - Simple payback period
- **Complete a summary report**

When to select this audit level:

- **If there is doubt about the buildings energy saving potential**
- **To identify which buildings in portfolio have the greatest potential savings**
  - Use as a screening for level 2 and level 3 audits

Prioritized list of simple payback periods

Table 4: Plug Loads Conservation Measures – Summary

ECM #	ECM Description	Annual Electricity Savings (kWh/yr)	Annual Gas Savings (MMBtu/yr)	Annual Energy Cost Savings ($/yr)	Annual O&M Cost ($/yr)	Total Installed Cost ($)	Simple Payback Period (years)
4.1	Remove Non-Essential Personal Printers and Consolidate Networked Printers	9,724	0	$778	$0	$750	1.0
4.2	Delamp Vending Machines and Install Misers	1,840	0	$147	$0	$430	2.9

Energy Conservation Measure (ECM)

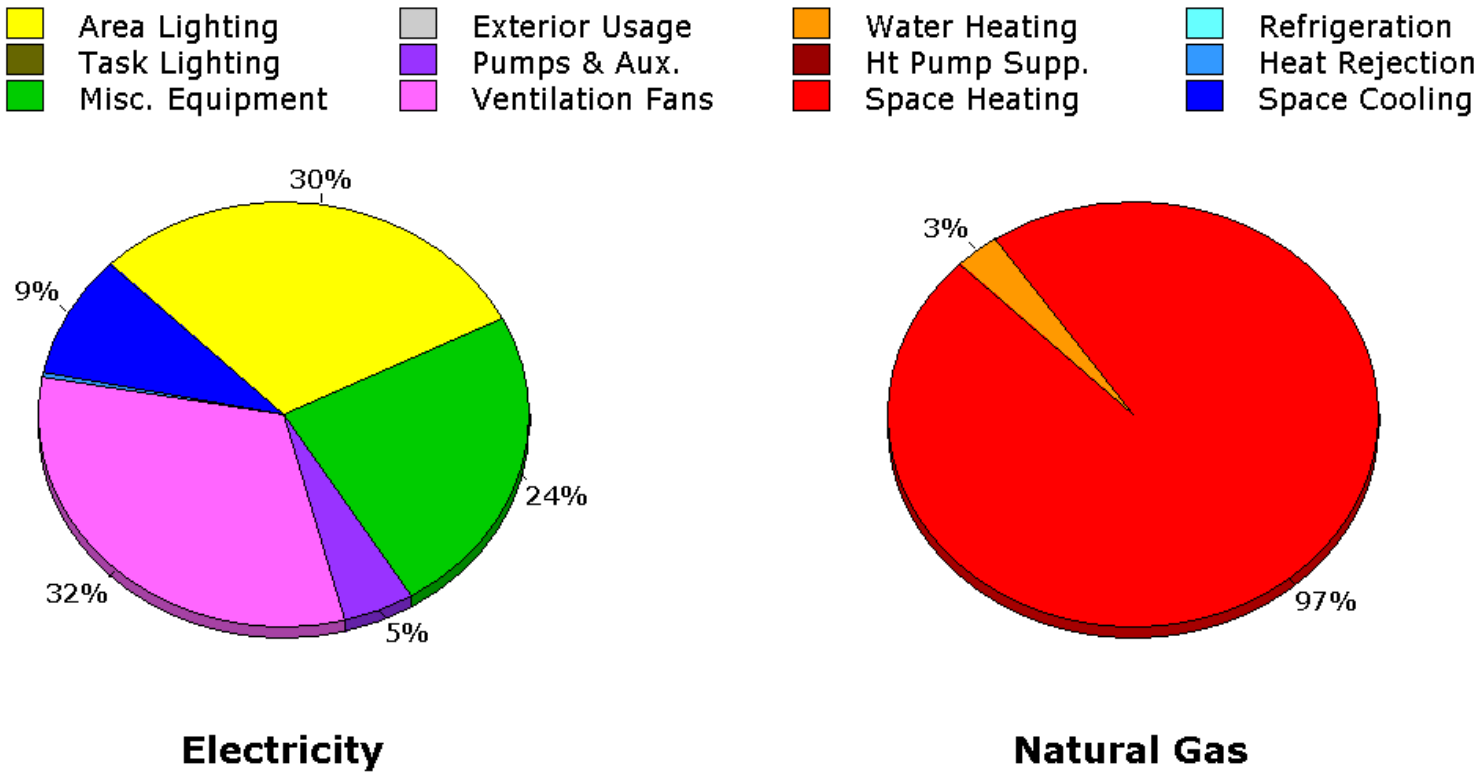
Level 2: Energy Survey and Analysis

- **More detailed survey of building**
- **Breakdown of energy use in buildings**
  - Initial energy modeling
- **More detailed cost and savings analysis for all practical measures**
  - Some spreadsheet calculations and simple energy modeled savings
- **Discussion of operation and maintenance impacts**
- **List potential capital-intensive improvements**
  - Discuss need for more detailed data collection and analysis
  - Provide initial estimate of cost and savings (simple payback)

When to select this audit level:

- **Default audit level for most buildings**

Building energy use breakdown



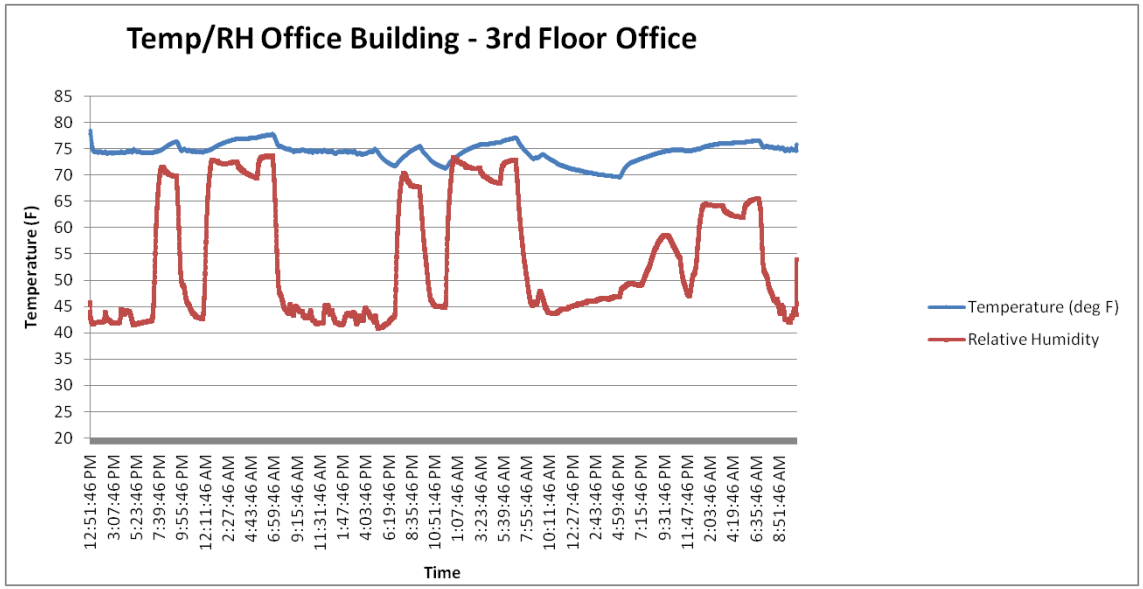
Level 3: Detailed analysis of capital-intensive measures

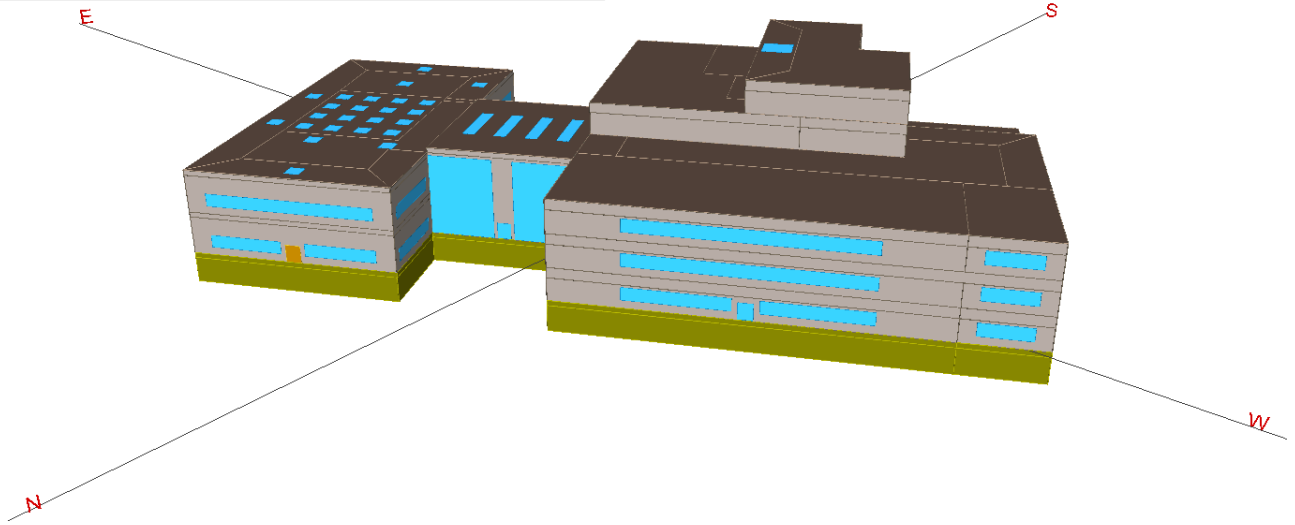
- **More detailed field data gathering and engineering analysis**
  - Sub-metering
- **Detailed project cost and savings analysis**
  - Detailed energy modeling
  - Life cycle cost analysis

When to select this audit level:

- Large capital-intensive projects

Sub-metering and energy models





Keep in mind: There are not sharp boundaries

- **All buildings are different**
  - More complex buildings can mean a different approach to the audit
- **Assessments should be customized to meet site needs**
  - Audit level definitions are not rigid, but should capture the objectives of the assessment
- **Level 2 provides a guideline for the most common energy audit**
  - Prioritize buildings by energy use intensity (EUI) and start working down the list

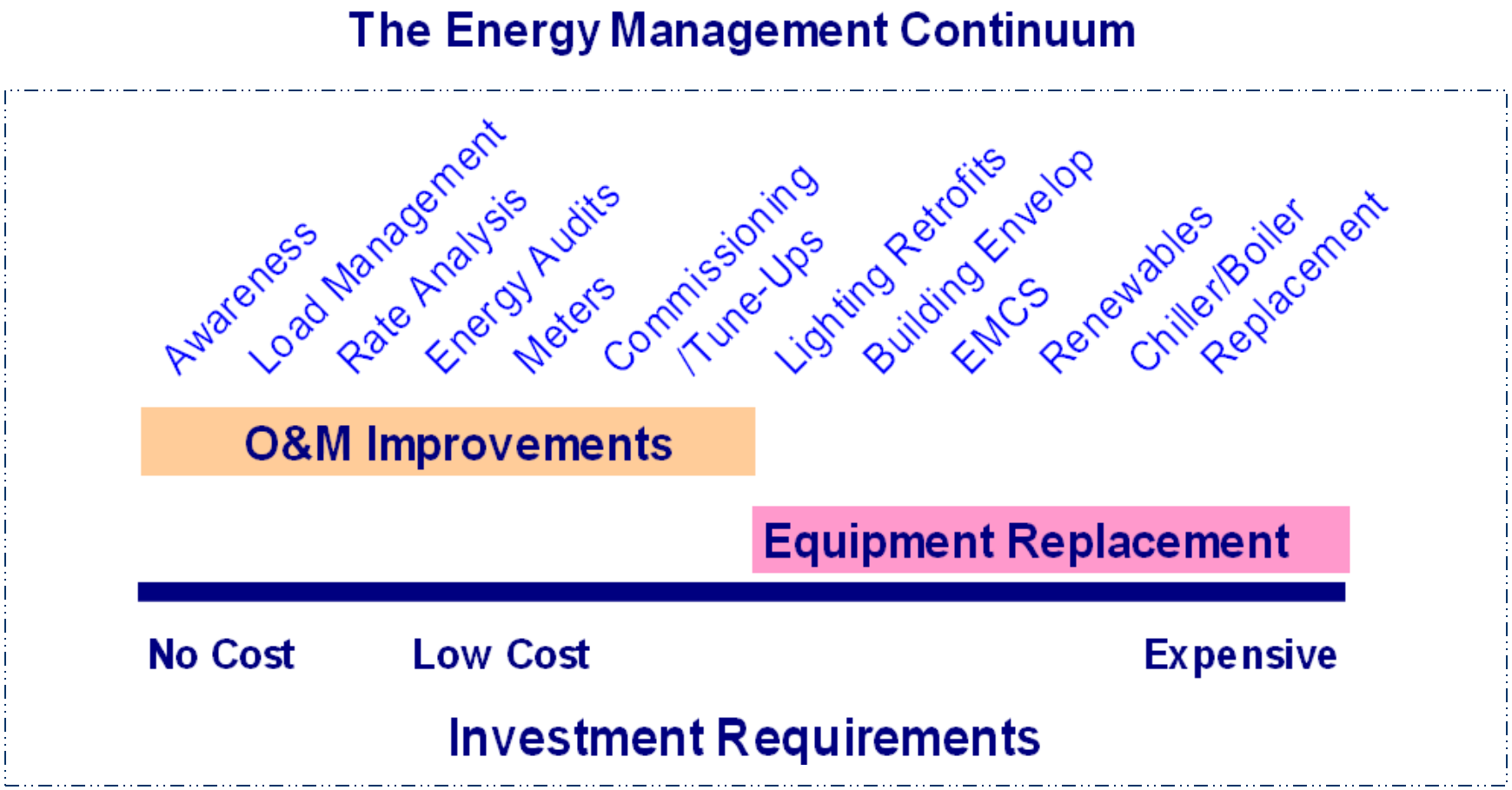
Validate results

Sanity Checks	Obvious mistakes, orders of magnitude off, inapplicable measures
Compare EUI and Savings	EUI falls in range for building type, savings brings EUI down
Document Review	Spelling errors, duplicate numbers, tables match summary
Cost of Measures	Costs are sourced, material, labor, and contingency included
Building Descriptions	Description has details of existing condition, # of components, proposed change with specs, list of current site best practices
Energy Savings	Reasonable % savings, breakdown matches systems, systems interactions capture
Utility Bill Analysis	Bills match records, actual rates used vs. blended, weather normalization, have historical spikes been explained
Verify Assumptions	Schedule assumptions, wattages, and % reductions seem reasonable
Life Cycle Costing	Discount rates, escalation rates appropriate, Operations and Maintenance (O&M) included in analysis
Equipment Life	Realistic life (25 for renewable energy, 15 for HVAC, 10 for lighting)
List of ECMS	Was anything missed (consult facilities staff), can ECMs be implemented, have barriers been addressed

Post audit action items

- **Where you stand now:**
  - You picked an auditor
  - The assessment was completed
  - You reviewed/accepted the report
  - You have a list of projects
  - You want to get the projects implemented
- **Next Steps**
  1. Prioritize list of projects
  2. Look for funding from within the organization
  3. Check for incentives and utility programs that offer grants/rebates
  4. Identify alternative finance options

1. Prioritize projects



2. Look for ways to fund a project

- **Federal, state, local and utilities**
  - Allocated funding
  - Special energy funds
  - O&M budget
  - Dedicated facilities improvement fund
  - Low interest energy efficiency loans
  - Grant programs
  - Bond programs
  - Utility rate discounts
  - Industry Recruitment/Support
  - Leasing/Lease Purchase Programs

3. Look for incentives

Database of State Incentives for Renewables and Efficiency (DSIRE)

http://www.dsireusa.org

- Production incentives
- Rebates
- Utility incentives
- Tax incentives
  - Tax incentives can only be claimed by an entity that pays taxes

4. Investigate alternative finance options

What is Alternative Finance?

- Finance options that can be used concurrently or independent of current operating budgets and appropriations to fund projects.

Types

- **Energy Savings Performance Contracts (ESPCs)**
  - A contractor installs, maintains, and finances energy projects and guarantees the resulting savings which are used to pay for the project over time.
- **Utility Energy Service Contracts (UESCs)**
  - A utility company installs, maintains, and finances energy projects and recovers the resulting savings used to pay for the project over time through utility invoices.
- **Power Purchase Agreements (PPAs)**
  - A private entity finances power generation equipment and the site purchases the power through a long-term agreement.
- **Enhanced Use Leases (EULs)**
  - Allows agencies to lease out available property (land and facilities) to the private sector in return for cash and/or in-kind consideration.

Energy audit checklist

- ❑ Find certified auditor
- ❑ Select appropriate audit level
- ❑ Build the team
- ❑ Stay engaged (participate in walk-through, maintain contact, quickly address questions)
- ❑ Perform thorough review of results
- ❑ Prioritize measures
- ❑ Implement measures
- ❑ Tell everyone what you did!

Resources

- FEMP website:
  http://www1.eere.energy.gov/femp/program/sustainable_existing.html
- TAP webinars:
  http://www1.eere.energy.gov/wip/solutioncenter/webinars.html
  - Energy Audit and Retro-Commissioning Policies for Public and Commercial Buildings
  - Effective O&M Policy in Public Buildings
  - Low-to-No Cost Strategy for Energy Efficiency in Public Buildings
  - Public Buildings Retrofits Program
- FEMP First Thursday Seminars:
  http://apps1.eere.energy.gov/femp/training/first_thursday_seminars.cfm
- NREL Energy Assessment Training Course:
  http://en.openei.org/wiki/NREL-Energy_Assessment_Training_Course
- Simuwatt Audit: www.simuwatt.com

Using Energy Audits in Energy Efficiency Programs

Lessons Learned, Successes, and Examples

Background

Governor's Energy Office (GEO)

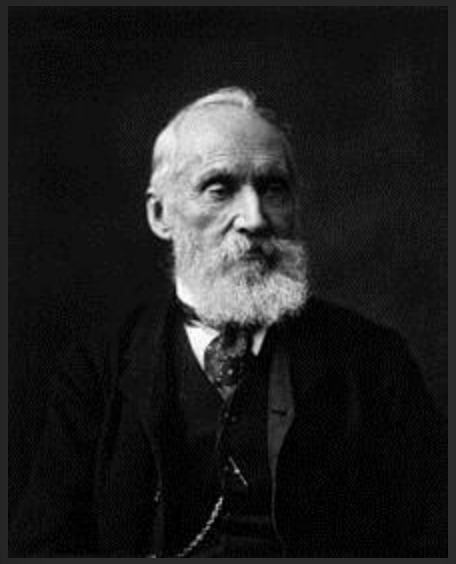
\+ American Recovery and Reinvestment Act of 2009 (ARRA)

RECOVERY.GOV

= GO! (Stop! GO! GO! GO!)

Background

- “If you cannot measure, then your knowledge is meagre and unsatisfactory” – Lord Kelvin



Colorado Governor’s Energy Office Final ARRA Evaluation Report
Submitted to The GEO
By Nexant
In partnership with Group 14 and Research Into Action
April 11, 2012-rev

Designing Audit Programs

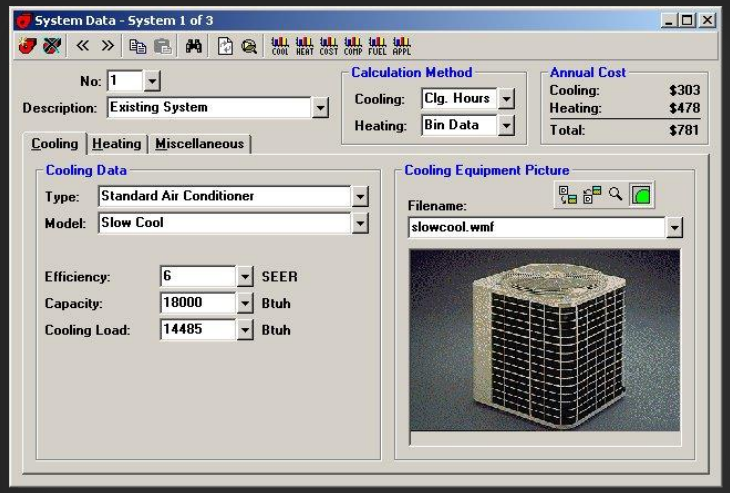
- Design to verify
- Implement strategically
- Require stakeholder resources
- Find local partners

Using Audits in Programs

- Validate methodology/data
- No reports without next steps
- Summarize and simplify
- Integrate, leverage and share

Common Audit Issues

- Lack of coordination with building staff/users
- Not accounting for synergistic effects
- Energy bill analysis not completed prior to building audit
- Lack of energy balance diagrams/explanations

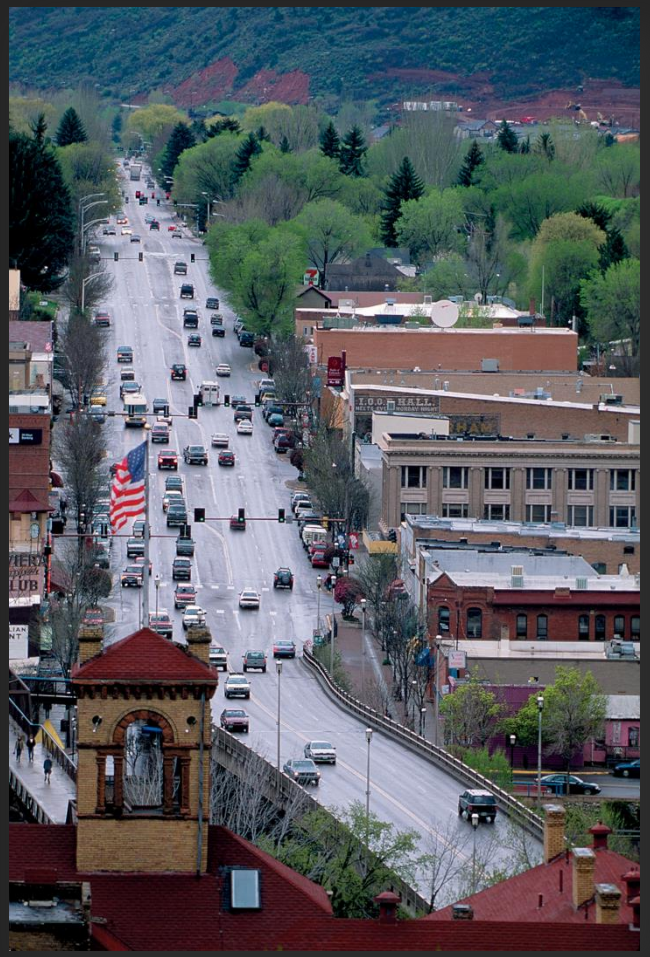


Case Study 1 – Small Commercial

What it was…

- Goal to assist local businesses reduce energy costs, create local jobs and reduce carbon emissions
- GEO/ ARRA funds used to support/incubate local programs that support local businesses

Main Street Energy Initiative (MSEI)



Program Parameters

Timeline

Feb – Mar 2010	Program Development
April 2010	Program Launch
Fall 2011	MSEI goals achieved and reported, GEO funding

4 Program Types

- MSEI in a Box
- Competitive Grant
- Energy Efficiency and Conservation Block Grant (EECBG) Self-Managed Programs
- EECBG GEO-Managed Programs

Program Message

Program Support - MSEI in a Box

What is it…

- A roadmap to implementing local ‘Main Street’ programs
- Resources to guide the program
- Resources to assist local businesses manage and reduce energy and costs
- Training for all aspects of energy management

MSEI in a Box

What's inside the Box…

1. Program Goals & Outcomes
2. Energy Data Management
3. Outreach, Education & Recognition
4. Facility Assessment
5. Energy Conservation Measures (ECM) Implementation
6. Project Financing
7. Measurement & Verification

MSEI Audits

- Range from rebate application to investment grade
- Customized by program, need
- Selectively verified/audited
- High realization rate

Results

Local Partners	30
Jobs Created	46
Contractors Employed	235
Businesses Engaged	819
Dollars Saved (Annual)	$803,368
Rebate Dollars	$1,811,618
Dollars Invested	$3,989,774
Kilowatt-hour (kWh) Saved	6,604,200
Therms Saved	438,153
% of Energy Reduced	15%
Total SF	5,374,416
Tons CO2 Reduced	5135

Lessons Learned

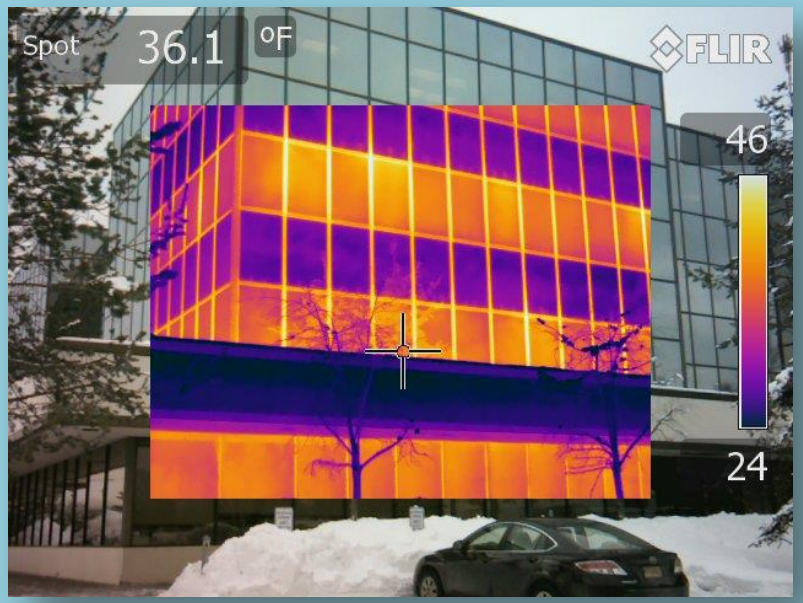
- Question assumptions!
- Money talks, but matched money talks louder
- The market for small commercial retrofits is underserved due to low margins, difficult entry and lack of skilled labor in small markets
- Simpler design = less headaches and easier reporting
- The auditing expertise is becoming more and more available; much less of a limiting factor

Case Study 2 – Large Commercial/Public

The challenge…

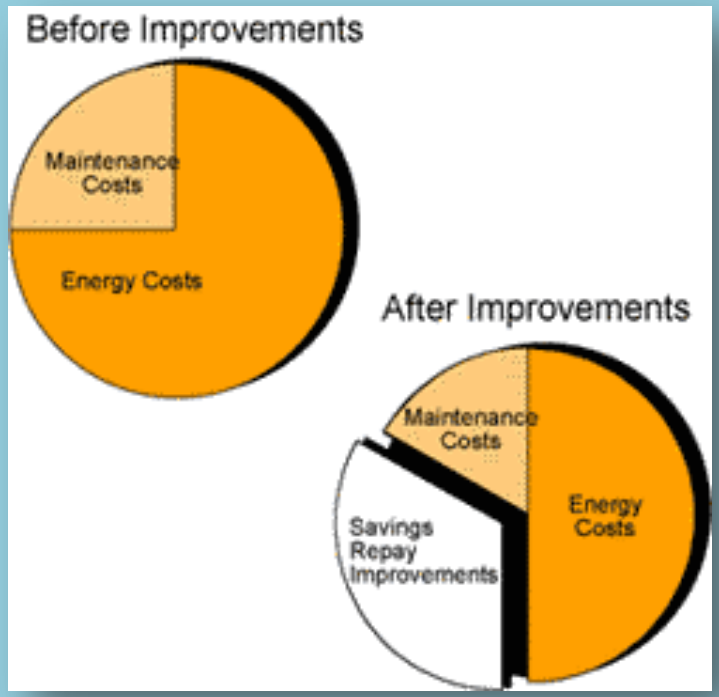
- Making sure Technical Energy Audits (TEAs) are being utilized in the most effective and fair means possible

- Provide third-party solution in Public Entity/Energy Service Company (ESCO) scenario



Energy Performance Contracting (EPC)

- Process through which energy efficiency and capital improvements are funded (either fully or partially) by the energy and maintenance cost savings generated by the improvements themselves when the cost savings are financed over a period of time



Colorado Program Overview

- GEO pre-qualifies ESCOs
  - Simplifies the selection process
  - Ensures highest level of quality
  - Annual review and re-approval process
- Standardized process/procedures
- Standardized contract documents
- ESCOs under contract with GEO to use GEO contracts and processes
- On-going guidance/support from GEO
- Technical reviews of deliverables

EPCs and TEAs

Problems

- Questionable business practices
- Lack of standards and uniformity
- Ultimately, muddying the water

Solution Process

- Engage stakeholders
- Examine data
- Define standard
- Require accountability
- Revisit as needed

iStock/Francis Black

Colorado Solution

- Fixed cost for TEAs
- Based on distance from Denver

- TEA agreement is reviewed and included as part of the entire EPC
- TEAs reviewed for consistency and accuracy

Results

- Average between $30-$40 million in total statewide EPC activity annually
- State program recognized as a national leader and model

Lessons Learned

- Playing outside of the system can only be limited, not eliminated
- The market appreciates certainty
- Better audits really do lead to better projects
- Since the TEA and development of ECMs is an ongoing process, some flexibility is needed with formal reports and discrete timing

Takeaways/Conclusions

- Energy audits don’t do anything, but they have a large impact on how things are done
- Consistent standards yield consistent results
- Storytelling data should generally be tracked
- Not leveraging energy audits is a missed opportunity
- To be useful, energy audits must be comprehensible

More Conclusions/Opinions

- The energy auditing business in both the residential and small commercial markets is tough and in some cases prohibitive for both users and providers
- There is a need for (continued) third-party verification of energy audits
- Programs that foster the growth of energy auditing need to consider total demand and long-term market forces

Thank You!

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