Audit Background

- Federal requirement: EISA Section 432
  - Quadrennial comprehensive energy and water evaluation of covered facilities
  - “identify and assess recommissioning measures … for each such facility”

- Non-Federal: ASHRAE Guidelines
  - Describes audit levels and outcomes:
    - Level I – Site Assessment or Preliminary Audits
    - Level II – Energy Survey and Engineering Analysis Audits
    - Level III – Detailed Analysis of Capital-Intensive Audits (a.k.a. investment grade audits)
  - Proposed Standard 211 – Procedures for Commercial Building Energy Audits

- EO13693: Section 3(a)(i)(A)
  - … promote energy conservation, efficiency, and management by … using remote building energy performance assessment auditing technology
Federal Facility Audits

• Currently energy audits are performed by federal agencies in an ad hoc fashion, with varying levels of success ranging from full compliance to very low EISA compliance. $$$

• The quality and usefulness of energy audits also varies greatly from agency to agency and audit to audit.

• Is there an interest in adopting a standardized approach, to include remote audits, that will work across many different agencies?
Assessments/Audits - The Rest of the Story

- EISA 432 – “comprehensive energy and water evaluation” per 42 USC 8253
- Renewable Energy
  - “ensure that, to the extent economically feasible and technically practicable, of the total amount of electric energy the Federal Government consumes” per 42 USC 15852, and
  - “(c) ensure that the percentage of the total amount of building electric energy consumed by the agency that is renewable electric energy is” per EO 13693
- Guiding Principles – “Each agency is responsible for evaluating the agency’s buildings portfolio for compliance with the Guiding Principles.” (Source EO 13693)
Audit Approaches Today

- Audits are conducted by agency staff, federal contractors, ESCOs* and utilities.
- Generally 432 compliant audits are based on ASHRAE Level II.
- Audit formats vary greatly.
- Audit results are not readily available for use.
- Remote audits are not defined by EO (or ASHRAE).
- Desk audits are not defined.
- EISA, RE and GP audits done with little coordination. $$$$

*Energy service companies
An Audit Tool Evaluation Example

  - EnergyIQ by LBNL
  - Laboratory Energy Efficiency Profiler (LEEP) by LBNL
  - Facility Energy Decision System (FEDS) by PNNL
  - eQUEST by LBNL
  - simuwatt™ Energy Auditor by NREL – not yet available
<table>
<thead>
<tr>
<th>Software</th>
<th>EnergyIQ™</th>
<th>LEEP</th>
<th>FEDS</th>
<th>eQuest®</th>
<th>simuwatt™</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description summary from software literature</td>
<td>“Action-oriented” benchmarking tool for non-residential buildings—bridges a gap by providing a standardized opportunity assessment based on benchmarking results, along with decision-support information to help refine action plans.</td>
<td>Helps users to quickly identify and prioritize potential energy efficiency actions in laboratory facilities. It does not require users to have any specialized knowledge of energy audits or analysis.</td>
<td>Windows-based program requires only minimal user experience and input to perform energy efficiency assessment screenings as well as detailed energy retrofit project analyses across a wide variety of building types, from single buildings to large multi-building campuses and installations.</td>
<td>A sophisticated, yet easy to use building energy use analysis tool, which provides professional-level results with an affordable level of effort. This freeware tool was designed to allow you to perform building energy use simulation.</td>
<td>Replaces the clipboard-and-pencil approach of most building audits with a package that uses sophisticated, comprehensive computer modeling to find more potential energy savings. Tablet-based front-end working with EnergyPlus energy simulation modeling software and OpenStudio.</td>
</tr>
</tbody>
</table>
The purpose of this ASHRAE standard is to **establish consistent practices for conducting and reporting energy audits for commercial buildings**. This standard:

- Defines the procedures required to perform Energy Audits Levels 1, 2 and 3,
- Provides a common scope of work for these audit levels for use by building owners and others,
- Establishes standardized industry practices for conducting energy audits, and
- Establishes minimum reporting requirements for the results from energy audits.
Using Audit Data

BuildingSync can facilitate a **consistent history** of energy audit data across the life of a building or a group of buildings. It can also allow easier **aggregation and analysis of audits** conducted by different companies using different software.
Remote Audits – This is new.

• In general, use building interval data and building information as available:
  – Interval utility (electric) consumption data
  – User provided information on the building and its systems
  – Digital and aerial photos and satellite images

• Benefits – significantly reduced time and cost to complete $

• Analyses
  – Ongoing: PNNL analysis to compare results of remote audits with results of traditional audits done at four installations.
    • Target completion date of late March 2016
    • Analysis to look at ECMs with identified energy and cost savings estimates; types of projects identified (end uses, building controls, low-/no-cost, capital projects, etc.); cost to perform filed audits and analysis ($/building, $/ft²); and more
EISA 2007 Section 432 Compliant Desk Audits

• Challenge: DOT’s FY12 compliance rate: 12.2% (71 buildings)
• Result: DOT’s current compliance rate: 45.8% (242 buildings)
• Keys to Success:
  – 26 site visits
  – 236 desk audits (with verification from utility data and questionnaires)
  – Close coordination between FAA ATO, DOE HQ, NREL and contractor

• Additional benefits
  – Completed audits allowed for consideration in ESPC projects
  – Feeds Compliance Tracking System requirements.
  – Performing desk audits resulted in $1 million in savings
  – Opportunity for FEMP to pilot a new resource for other agencies
**ECMs Found**

<table>
<thead>
<tr>
<th></th>
<th>Lighting</th>
<th>Desktop to Laptop</th>
<th>CRT Monitors</th>
<th>HVAC efficiency improvement</th>
<th>Cogged V-belts</th>
<th>Enable Economizer</th>
<th>UPS Efficiency</th>
<th>HE Motors</th>
<th>HVAC Optimization</th>
<th>Zone Setpoint Reduction</th>
<th><strong>Other Improvements</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Times Encountered</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(# of sites)</td>
<td>25</td>
<td>8</td>
<td>10</td>
<td>22</td>
<td>6</td>
<td>7</td>
<td>15</td>
<td>14</td>
<td>17</td>
<td>10</td>
<td>2 to 5</td>
</tr>
<tr>
<td><strong>Percentage</strong></td>
<td>96%</td>
<td>31%</td>
<td>38%</td>
<td>85%</td>
<td>23%</td>
<td>27%</td>
<td>58%</td>
<td>54%</td>
<td>65%</td>
<td>38%</td>
<td>8 to 19%</td>
</tr>
</tbody>
</table>

**Other improvements include zone temperature, insulating ducts, CV to VAV, indirect evaporative cooling and envelope improvements.**
Value of the Desk Audits

Value of Providing Audits

• Total cost for onsite and Desk audits ~ $300,000
• Avoided cost ~ $1.3 million

Electricity Savings

• Potential savings for all ASRs and ARSRs of 14.8 million kWh/year
  (equivalent to about 1.3% of DOT’s total electricity use)

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

Performance-Based Contract Consideration

• About 60 ASRs and ARSRs now being considered as a result of the desk audits.
The Bigger Audit Question

• Is there an interest in coordinating efforts and adopting a standardized approach, to include remote audits, that will work across many different agencies possibly including:
  – Qualification of auditors
  – Procurement tools, e.g. SOWs and GCEs
  – A portfolio of approved auditing tools
  – A data management standard
    • Including a feed into the Compliance Tracking System
Why Now?

• EO advocates remote building energy performance assessment auditing practices.
• Numerous studies on audit tools and approaches under way by Federal agencies and DOE laboratories.
• Audit standards under development by ASHRAE.
• Data management tools are under development by DOE.
Thank You

Brad.Gustafson@ee.doe.gov
Backup Slides
Industry Auditing Solutions

There are currently a large number of tools on the market that have been designed to streamline and improve the quality of energy audits and energy analysis. A subset are cataloged below.

<table>
<thead>
<tr>
<th>Tool</th>
<th>Description</th>
<th>Level</th>
<th>Details</th>
<th>Approved</th>
</tr>
</thead>
<tbody>
<tr>
<td>EnergyIQ</td>
<td>Benchmarking, EE Screening</td>
<td>Lvl 1</td>
<td>Develops a benchmark based on user inputs and utility data, helps target EE categories. Does not do a full energy audit, but preliminary steps.</td>
<td>No</td>
</tr>
<tr>
<td>LEEP</td>
<td>Laboratory Efficiency Screening</td>
<td>Lvl 1</td>
<td>Screens for EE opportunities in Laboratories for further investigation. Does not do an energy audit, but screens for targeted measures.</td>
<td>No</td>
</tr>
<tr>
<td>FEDS</td>
<td>Single and Campus Auditing</td>
<td>Lvl 2</td>
<td>Uses building surveys to extrapolate EE over campuses, can be used as the analysis platform for energy audits.</td>
<td>No</td>
</tr>
<tr>
<td>eQUEST</td>
<td>Building Energy Modeling</td>
<td>Lvl 2, Lvl 3</td>
<td>Used in the analysis step of energy auditing. Can do pricing and LCCA. No data collection aspects or reporting for energy auditing.</td>
<td>No</td>
</tr>
</tbody>
</table>
## Industry Auditing Solutions

<table>
<thead>
<tr>
<th>Tool</th>
<th>Type</th>
<th>Levels</th>
<th>Description</th>
<th>Available</th>
</tr>
</thead>
<tbody>
<tr>
<td>simuwatt</td>
<td>Commercial Energy Auditing</td>
<td>Lvl 1, Lvl 2, Lvl 3</td>
<td>Software guided workflow to streamline auditing and store data in the cloud. Supports auditor from data collection through report generation.</td>
<td>Yes</td>
</tr>
<tr>
<td>Retroficiency</td>
<td>Virtual and On Site Energy Audits</td>
<td>Lvl 1, Lvl 2, Lvl 3</td>
<td>Multiple steps of auditing offered, virtual, survey, in person, efficiency improvement tracking, very low cost. Geared towards data analytics.</td>
<td>Yes</td>
</tr>
<tr>
<td>FirstFuel</td>
<td>Virtual Energy Audits</td>
<td>Lvl 1</td>
<td>Virtual audits, very low cost, can detect operational issues. Geared towards data analytics and can be used to track efficiency gains.</td>
<td>Yes</td>
</tr>
<tr>
<td>ecoInsight</td>
<td>Tablet Audit Tool</td>
<td>Lvl 1, Lvl 2</td>
<td>Software guided workflow, geared towards selling EE measures</td>
<td>Yes</td>
</tr>
<tr>
<td>BPI</td>
<td>Data Collection Forms</td>
<td>Lvl 1, Lvl 2, Lvl 3</td>
<td>Developed data collection worksheets, modeled after ASHRAE resources. Geared towards self-employed auditors. No analysis platform is included in the sheets. Traditional type audit.</td>
<td>No</td>
</tr>
<tr>
<td>RMI</td>
<td>Data Collection Forms, Worksheets</td>
<td>Lvl 1, Lvl 2, Lvl 3</td>
<td>Developed data collection worksheets and calculation worksheets using industry best practices. Traditional pen and paper type audit.</td>
<td>No</td>
</tr>
</tbody>
</table>