Industrial Energy Efficiency Assessments

Lynn Price
Staff Scientist
China Energy Group
Energy Analysis Department
Environmental Energy Technologies Division
Lawrence Berkeley National Laboratory
Industrial Energy Efficiency Assessments

– Definition and overview of key components
– International experience
– Chinese situation and recommendations
– US-China collaboration
Industrial Energy Efficiency Assessments

- Analysis of the use of energy and potential for energy efficiency in an industrial facility
  - Current situation
  - Recommendations for improving energy efficiency
  - Cost-benefit analysis of recommended options
  - An action plan for realizing potential savings

Types of Industrial Energy Efficiency Assessments

- Preliminary or walk-through
- Detailed or diagnostic
Energy audit preparation

Auditing criteria
Select audit team
Audit plan
Prepare checklists
Data inventory and baseline development
Collect energy bills and available data
Preliminary analysis

Energy audit execution

- Data inventory and baseline development
- Analyze energy use patterns
- Identify, analyze, and quantify energy-saving projects
- Conduct financial analyses
- Develop energy-saving recommendations

Energy audit reporting

- Prepare audit report with energy-saving project recommendations

Post-audit activities

- Prepare action plan with energy-saving projects for implementation
- Implementing the action plan
Identifying Energy Efficiency and Energy Cost Reduction Opportunities

— Cross-cutting
  • Steam systems
  • Process heating systems
  • Compressed air systems
  • Electric motor systems
  • Fan and pumping systems
  • Lighting systems

— Sector-specific
  • US EPA ENERGY STAR energy efficiency guidebooks
  • LBNL energy efficiency guidebooks
  • US DOE Industrial Technologies Program resources
  • EU Best Available Technology reference documents
Cost-Benefit Analysis of Energy-Efficiency Opportunities

- Cash-Flow Diagram
- Life-Cycle Cost Analysis (LCCA)
- Net Present Value (NPV) Analysis
- Internal Rate of Return (IRR) Analysis
- Simple Payback Period (SPP) Analysis

Prepare an Energy Assessment Report

- Document current situation (energy baseline)
- Provide detailed recommendations for energy-efficiency and carbon dioxide emissions mitigation opportunities
- Provide detailed cost-benefit calculations
Industrial Energy Audit/Assessment Programs: International Experience

— Various models used around the world
— Reviewed 22 programs in 15 countries, plus the EU
— Identified common elements for successful energy audit programs
  • Organization and coordination
  • Establishing program goals, scope, size
  • Types of audits offered
  • Supporting measures
    • Subsidies for assessments
    • Investment incentives
    • Technical assistance
    • Publicity
## U.S. DOE Industrial Energy Assessments

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<th>Targeted Companies</th>
<th>Implementing Entities</th>
<th>Duration</th>
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| **Large energy-intensive plants** (<span style='font-size:12pt'>≥500 Billion BTU/year in primary energy</span>) | Energy Experts - BestPractices Qualified Specialists | **3-day system assessment** | Apply DOE’s software tools and technical assistance to a specific area  
Provide hands-on learning to plant personnel | Free and cost-shared for LEADER companies |
| **Small and medium enterprises** (<span style='font-size:12pt'>> 26 Billion Btu/year, but <500 billion Btu/year in primary energy</span>) | University-based Industrial Assessment Centers (IACs) | **1-day assessment** | Highly trained IAC faculty and students apply DOE software and technical assistance  
Identify energy-saving opportunities | Free of charge to SMEs if eligible |
| **All plants** | Information Center of Energy Efficiency & Renewable Energy at DOE | **N/A** | Technical assistance and guidance to all sizes of plants  
Customized energy efficiency consultation to SMEs  
Providing information on energy management and financial support | Free of charge |
U.S. DOE Energy Assessment Program: Industrial Assessment Centers (IACs)

- Focus on small and medium sized manufacturing facilities
- 26 university-based IACs train engineering students for careers in industrial energy efficiency
- Provide 1-day assessments, assessment reports with recommendations, follow-up
- IACs serve 300+ plants per year
- Typically Identifies $175,000 to $200,000 in potential annual energy savings per plant
- Average implementation rate of 35% to 45%
U.S. DOE  Save Energy Now LEADERS Program

- Corporate Commitment
  - Voluntary pledge to reduce energy intensity by 25% or more over 10 years
  - Designate an energy manager, develop an energy intensity baseline and energy management plan
  - Take steps to reduce energy intensity and carbon emissions
  - Report results annually to the U.S. DOE

- Benefits to Participating Companies
  - Gain enhanced access to enabling resources
    - Tailored technical assistance
    - Training
    - Assessments
  - Receive high-level recognition for achievements and enhance corporate image

- Results since 2006
  - 105 LEADER companies – including 7 of the top 50 U.S. industrial energy consumers - have signed the LEADER Pledge
  - LEADER companies represent over 1,000 plants
U.S. DOE  Save Energy Now LEADERS Program

• Thus far, 47 LEADER Companies have submitted Annual Pledge Reports representing 845 plants
  – These companies have improved their energy intensity by over 3%—exceeding the LEADER goal of 2.5% annually
  – Nissan, 3M, and UTC hosted Showcases to encourage replication of best practices by others
• By 2015, the Save Energy Now LEADER initiative will cover 25% of the total U.S. industrial energy footprint

LEADER Achievements

✓ PPG Industries invested nearly $100K in energy projects recommended by two ESAs; 65% of identified projects have been implemented or are underway; realized >$1.1M in annual energy cost savings.

✓ OMNOVA Solutions Inc. plans to roll out ITP’s baselining process and energy metrics tracking worldwide.

✓ Alcoa hosted a Global Energy Summit in April 2011, featuring the company’s ITP partnership and results; plant managers from around the world attended.
U.S. DOE Energy Assessment Program:  
Save Energy Now Energy Savings Assessments (ESAs)

• System-specific assessments focus on steam, process heating, compressed air, pumping, or fan systems
• Assessment conducted by DOE Energy Experts
• Plant personnel and affiliates are exposed to the application of DOE software tools in their facility
U.S. DOE Energy Assessment Program: Qualified Energy Experts

• U.S. DOE Industrial Technologies Program conducts a qualification training program to provide qualified energy experts by system area
• Qualification workshops include classroom and hands-on instruction by highly experienced energy professions, written exams, and certificates
• Energy Experts are available for system-specific areas (e.g., compressed air, pumping, process heating, steam, and fan systems)
• Full list of qualified DOE Energy Experts is posted on DOE’s website, with a searchable database
# U.S. DOE Energy Assessment Program: Software Tools

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<th>Tools</th>
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<td>IAC Database</td>
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<td>Process-heating</td>
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<td>Process Heating and Survey Assessment Tool (PHAST)</td>
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<td>Fan System Assessment Tool</td>
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<td>Pumping System Assessment Tool</td>
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<td>Data Centers</td>
<td>DC Pro Software Tool Suite</td>
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Industrial Energy Efficiency Auditing in China

- LBNL assessment of current situation in China
- Many good energy audits being undertaken
  - Detailed Audits
  - Regular audits to meet government mandate
  - Special audits for quality assurance
  - Verification audits for processing incentive
  - Comprehensive audits for Identifying integrated solutions
- Targeted Audits (focus on subsystem or equipment)
- Walk-through Audits
- Investment-grade Audits
- Many organizations/institutions involved
Industrial Energy Efficiency Auditing in China: Recommendations

- Continuing policy push from the central government for energy audits
- Designate a national-level entity to lead the effort in organizing and coordinating energy audit activities
- Focus on assessing cost-effective saving opportunities rather than on energy accounting audit
- Create specific funding to support energy audits
- Develop standards and tools to effectively support energy audits
- Build strong capacity for energy audits
- Strengthen international cooperation in energy auditing
US-China Industrial Energy Efficiency Assessment Activities

- Memoranda of Understanding that include training programs and workshops
  - LBNL, ORNL, and the University Alliance for Industrial Energy Efficiency (UAIEE) at 1st US-China Energy Efficiency Forum May 2010
- China-U.S. Industrial Energy Efficiency University Partnership Symposium, October 2010
  - Hosted by the UAIEE
  - Presentations by US DOE, MIIT, ERI (of NDRC), ORNL, LBNL, IAC Directors and staff members
  - Presentations described the operation of IACs, tools and software developed by US DOE used by the IACs, database used for collecting and analyzing energy assessment results in the IACs, and US DOE industrial energy efficiency programs
US-China Industrial Energy Efficiency Assessment Activities

- Translation and Localization of US DOE Software Assessment Tools
  - Quick Plant Energy Profiler (QuickPEP)
    - In collaboration with the Center for Industrial Energy Efficiency
  - Process Heating Assessment and Survey Tool (PHAST)
    - In collaboration with Shandong University and the UAIEE

- QuickPEP Training Workshop, October 2010
US-China Industrial Energy Efficiency Assessment Activities

- National Energy Conservation Center, LBNL, and ORNL
  - Developing an English-Chinese energy efficiency dictionary
  - Exchanging study reports and publications related to industrial energy efficiency program design
- Holding an industrial energy efficiency assessment workshop in June 2011
  - Hosted by the Xi’an Energy Conservation Center
  - Focused on the use of the PHAST tool in the steel industry
Opportunities for Future Collaboration

- Continued assistance in localizing DOE industrial energy efficiency assessment tools
- Translation of IAC database with information on 15,000 industrial energy efficiency assessments and 112,000 recommendations (over 30 years of assessment activities)
- Additional workshops/training on:
  - DOE and IAC assessment procedures
  - Software tools
  - Assessment equipment
  - Qualification of energy auditors
  - Identification of efficiency measures
  - Financial analyses
  - Calculation of energy savings from implemented projects
Further Information

U.S. DOE’s Industrial Technologies Program
http://www1.eere.energy.gov/industry/index.html

U.S. DOE’s Industrial Assessment Centers
http://www1.eere.energy.gov/industry/bestpractices/iacs.html
http://iac.rutgers.edu/

LBNL’s China Energy Group
http://china.lbl.gov/

ORNL
http://www.ornl.gov/