Industrial Energy Efficiency

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

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How to Save Energy

1. Contract an energy audit
   - list of recommendations
   - act upon a subset of them (implementation)
   - **one time savings (5-15%)**

2. Implement an energy management program
   - hire or train energy aware technicians
   - support and implement energy based projects
   - consider energy in all decisions (purchasing, production, scheduling) at all levels
   - **continuous improvement and savings (30%-70%)**

UF Industrial Assessment Center

- DOE energy audits for small to medium sized manufacturing companies.
- Service North and Central Florida, South Georgia, and East Alabama.
- One or two day **on-site audit** followed by a **detailed report** and follow-up survey.
- Provide hands on energy management experience for engineering undergraduate and graduate students.

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DOE IAC Program

- 30+ year program; 26 University based centers
- Saved **243 trillion Btu** in 2008
- As of 2008 2,855 IAC students graduated
- IAC Program benefits:
  - **Objective information** to help make plants cleaner more energy efficient
  - Engineering students receive hands-on industrial experience
  - Universities build valuable **local industry relationships** to maintain a practical focus in their engineering curriculum

The Audit Process

- STEP 1: **Pre-Assessment Information Gathering**
  - Size of Plant and plant layout
  - Industry type (SIC/ NAICS code) and process description
  - Production levels, units and dollars, operating hours
  - A one year history of utility bills
  - List of major energy consuming equipment
- STEP 2: **Ensure that key plant personnel are involved**
  - Plant manger, Energy manager, Environmental personnel, Maintenance personnel
- STEP 3: **Pre-Assessment Analysis**
  - Analyze the manufacturing process
  - Analyze utility bills for trends and errors; establish unit cost of energy
  - Review design and other technical documentations
  - Identify possible energy saving potential recommendations
- STEP 4: **Assessment**
- STEP 5: **Post Assessment Activities**
  - Conduct engineering and financial analysis
  - Complete IAC Report
  - Follow-up to Report

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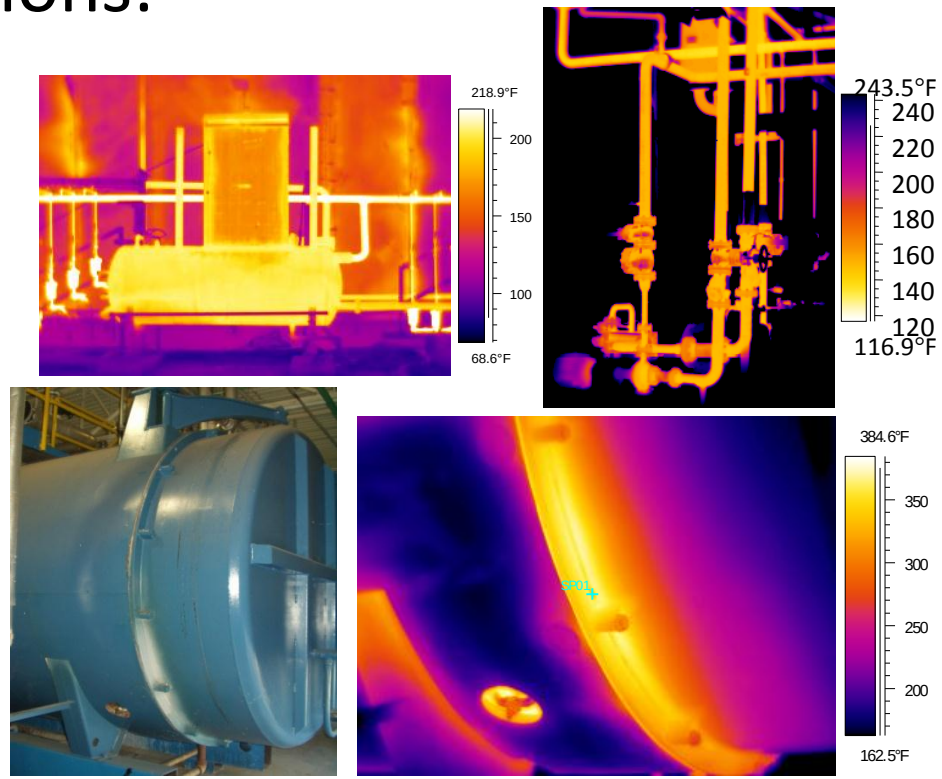
Assessment Recommendation (AR)

- Types of recommendations:
  - Energy Management
  - Lighting systems
  - Motors & pumps
  - HVAC
  - Heat/cooling recovery
  - Compressed air
  - Steam generation
  - Insulation
  - Building envelope



- Recommendations contain detailed technical and financial analysis of the potential savings.

UF-IAC – Saving Energy

http://iac.rutgers.edu/database/statistics/?CENTER=UF

Recommended Savings	Usage Reduction	% Reduction	Cost ($) Savings	Unit
All Energy	21,158	18.5%	$112,763	MMBtu
Electrical	1,798,108	26.7%	$92,185	kWh
Natural Gas	1,256	5.1%	$2,425	MMBtu

Implemented Savings	Usage Reduction	% Reduction	Cost ($) Savings	Unit
All Energy	4,784	4.2%	$26,167	MMBtu
Electrical	400,283	5.9%	$20,857	kWh
Natural Gas	420	1.7%	$2,146	MMBtu

Initial Plant	Usage	Cost ($)	Unit Cost	Unit
All Energy	114,549	$559,848	$6.80	MMBtu
Electrical	6,745,730	$376,186	$0.062	kWh
Natural Gas	24,430	$104,044	$2.69	MMBtu

Total Assessments: 441
Recommendations/audit: 8.5
Implementations/audit: 3.6

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Example Audit Recommendation

Replace Metal Halide (MH) lights with high bay fluorescent lighting.

- 400 Watt MH is cheap ($10 bulb)
- T8 Fluorescent (high bay $200, 6x$5=$30)

- MH has a restrike time (20 min)
- Fluorescent is 200 Watt and controllable
  - occupancy sensors ($80)
  - dimmable for daylight sensing
- Payback?

  (400W-200W)*8760h=1.75kW·h

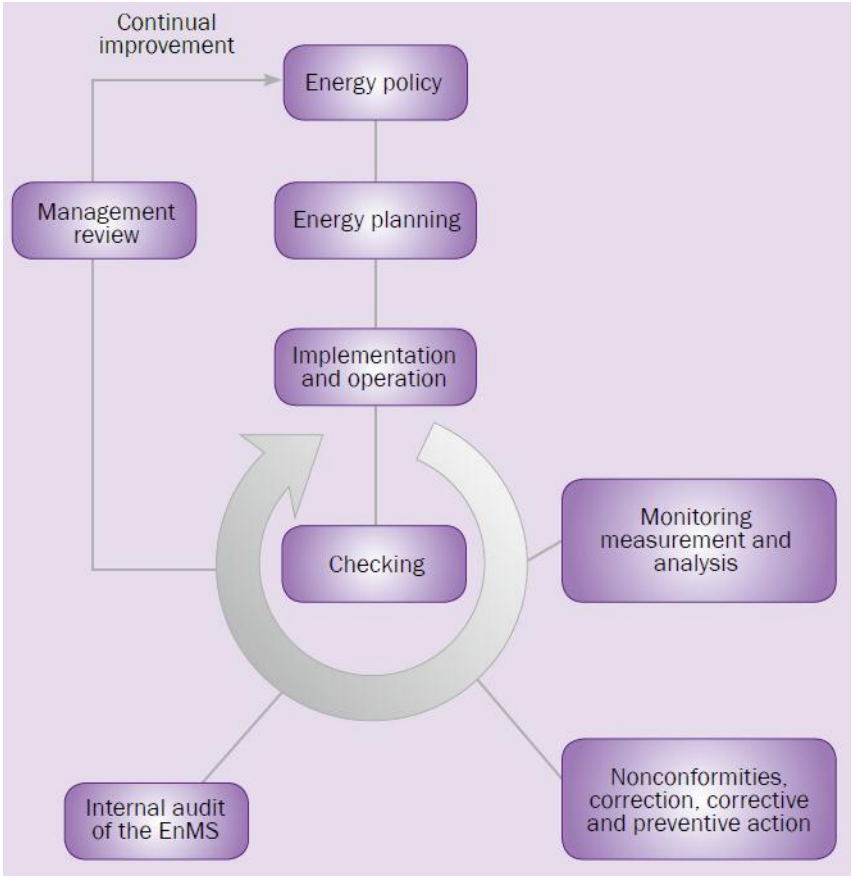
source: 1000bulbs.com, grainger.com

Quantifying Industrial Energy Savings

- Low hanging recommendations are often inexpensive, low risk, and most likely save money (5-15%).
- Large savings come from large investments and often have less marginal savings (30%?).
- Huge savings can come from process changes but most require intimate knowledge of the process (70%?).

Managing Energy

- **Requires commitment** (ISO 50001)
  - commitment to change
  - capital
  - continuous improvement
- Requires an educated workforce
- Requires data
- Requires validation



ISO 50001 plan-do-check-act cycle

http://www.iso.org/iso/iso_50001_energy.pdf

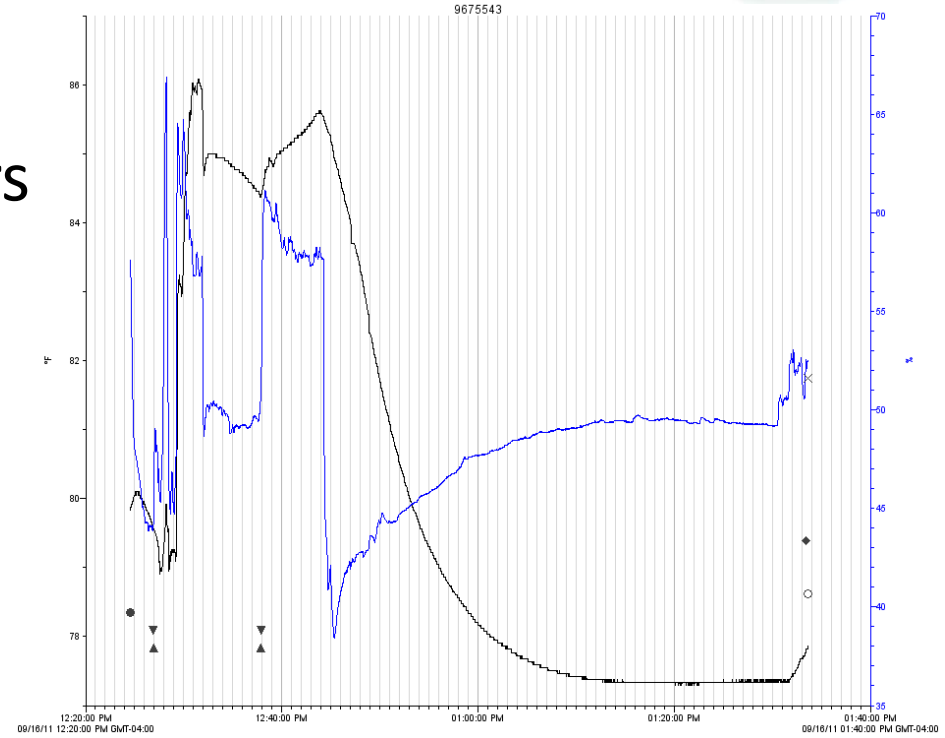
An Educated Workforce

- Integrated into curriculum
  - motivate in introductory courses
  - provide tools in technical classes
  - provide integration and experience with energy capstone course
- Industrial energy management classes
  - fundamentals of energy use
  - exposure to alternative technologies
  - measurement and validation
  - provide hands on experience (labs, audits, etc.)

http://grainger.com

Educated Savings (Data)

- Larger savings come from part load and process change
- Measurement and validation require data
  - standalone data loggers
  - handheld tools with data logging capability
  - equipment controls
  - process controls



http://onsetcomp.com, http://fluke.com

Putting it Together: Experience

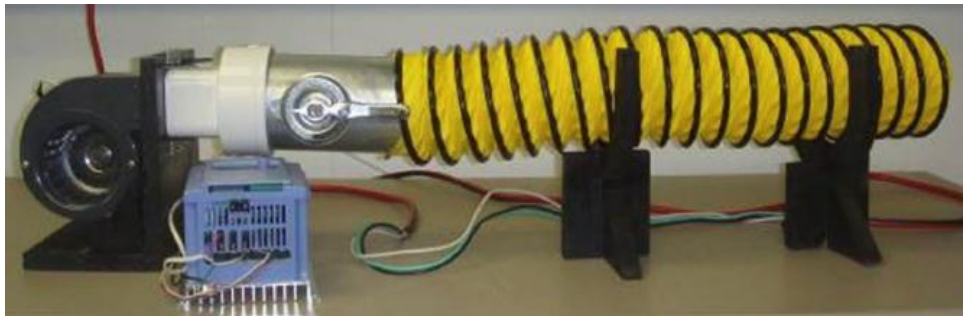
- Hands on experience is invaluable
  - instrument training
  - combine measurement, data logging, savings prediction and validation
- Onsite audits are invaluable
- The work/home provides many learning opportunities
- Basic kits under $100

  (current/voltage/PF, temperature, air velocity calculator, stopwatch, service meters)

http://professionalequipment.com 44550, P4400, PDT550; http://amazon.com AR-816

Energy Labs

- Assessment Training by Rutgers CASE (Preliminary DOE IAC program)
- Hands-on
- Fundamentals
- Measurement
- Low cost
- Portable



Continuing Education and Certification

- Certified Energy Manager (C.E.M) certification by the AAE
  - provides continuous continuing education
- DOE EERE website webinar series
  - many high quality educational materials, case studies, and software
  - webcasts, webinars etc.
    http://eere.energy.gov/industry/resources/webcasts.html
- Vendors often provide webinars and webcasts

References and Resources

- AEE CEM: http://aeecenter.org
- ISO 50001: http://iso.org
- DOE EERE ITP: http://eere.energy.gov/industry
- DOE IAC Program: http://iac.rutgers.edu
- Fluke instruments: http://fluke.com
- HOBO data loggers: http://onsetcomp.com

Questions?

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