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Converging Issues

- Uncertain energy supply
- Volatile energy prices
- Climate change
- Sustainability

*Energy Efficiency*

- Technology available today
- Continuous improvement in energy management through adoption of new technologies and practices
- Profitable business practice
The U.S. Department of Energy is delivering technology solutions

Collaborative R&D
- Energy-Intensive Process Technologies
- Crosscutting Technologies

Technology Delivery
- Energy Savings Assessments
- Industrial Assessment Centers
- Training and Tools
- Publications and Information

Partnerships
U.S. Industrial Sector: A Big Opportunity

32 quads or ~33% of total U.S. energy consumption

U.S. industry represents:
- 37% of U.S. natural gas demand
- 29% of U.S. electricity demand
- 30% of U.S. greenhouse gas emissions
- More energy use than any other single G8 nation
- Large opportunities for
  - Energy reduction
  - Emissions reductions
  - Fuel flexibility

Industrial Energy Use by Fuel Type
U.S. Manufacturing Sector Energy Use

U.S. Manufacturing Plants: By Size

<table>
<thead>
<tr>
<th>Size of Plants</th>
<th>Number of Plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small Plants</td>
<td>84,298</td>
</tr>
<tr>
<td>Mid-Size Plants</td>
<td>112,398</td>
</tr>
<tr>
<td>Large Plants</td>
<td>200,710</td>
</tr>
<tr>
<td>All Plants</td>
<td>397,404</td>
</tr>
</tbody>
</table>

Annual Energy Consumption (Billion Btu/yr)
- Small Plants: <25
- Mid-Size Plants: 26-500
- Large Plants: >500

Annual Energy Consumption ($/yr est.)
- <$100K
- $100K-$3M
- >$3M

Percent of Total Manufacturing Energy
- Small: 5%
- Mid-Size: 37%
- Large: 58%

Over 196,000 plants use 42% of U.S. manufacturing energy

2002 EIA MECS
Why focus on energy assessments? Pressing energy supply and cost issues

“Our Energy Saving Teams will work with on-site managers on ways to conserve energy and use it more efficiently.”

U.S. Department of Energy
Secretary Bodman
National Press Club
October 3, 2005

Secretary Bodman at the Caterpillar Tractor Assessment
The program encompasses four primary technology delivery channels

• **Save Energy Now ESA Assessments**
  Energy experts work with plant personnel to identify the best opportunities for energy savings at large industrial facilities

• **Industrial Assessment Centers**
  No-cost assessments provided to eligible small & mid-size plants by university-based teams

• **Tools and Training**
  Training in best practices and software tools to improve plant energy performance

• **Publications/Information**
  Websites, newsletters, webcasts, case studies, tip sheets, technical briefs, clearinghouse, allied partners, showcases, energy events, etc.
Energy Savings Assessments

- Assessments of targeted industrial systems by Qualified Specialist using the DOE software tools
- Energy Assessment Report identifies potential energy and cost savings
- Plants are selected by DOE based on several factors, including:
  - The plant’s energy consumption
  - The company’s intention to include other similar plants within their company
Principles of a Training Assessment

• Not a “fault-finding” activity but an activity that is designed to:
  – Share knowledge
  – Provide tools
  – Identify energy management best practices
  – Identify opportunities for improvement
  – Identify opportunities for replication.
Foster replication of energy management concepts by developing onsite resident expertise.

Train the Site Lead in energy management best practices and the use of the U.S. DOE Tools. (Energy Expert)

A Training-Assessment is not a standard industrial system assessment.

- The goal is not to complete a comprehensive system assessment.

• Target systems exhibit the following:
  - Significant operating costs,
  - Large loads
  - Large # of similar systems
  - Systems that have symptoms of problems.
The **Save Energy Now Energy Savings Assessment** process is well structured

- **Gather Preliminary Data**
- **Conduct Plant Visit**
- **Analyze & Report Results**
- **Follow-up**

**Train Plant Staff**

- Teams are DOE Energy Experts and plant personnel
- Teams focus on fans, pumps, compressors, steam or process heating systems
- Plant personnel are trained on DOE software tools
Assessment Expert spends 3 days on site

**Day 1**
- Safety briefing, tour plant
- Overview of DOE Tool to plant personnel
- Agree on potential energy efficiency opportunities to investigate
- Initiate data collection for potential opportunities

**Day 2**
- Continue data collection
- Apply DOE tool to quantify potential opportunities
- Plant lead and expert agree on opportunity results

**Day 3**
- Wrap up tool analyses
- Plant lead and expert ensure they agree on opportunity results
- Closeout meeting in p.m. to review results
Energy Savings Teams

- Teams composed of DOE Qualified Energy Experts and plant personnel
- Teams will focus on one of five DOE efficiency tools
- Plant personnel and affiliates will be trained on DOE efficiency tools

Manufacturing Energy Use by Type of System (%)

- Process Heating 38%
- Steam 35%
- Motor Systems 12%
- Electro-chemical 2%
- Process Cooling 1%
- Other 4%
- Facilities 8%

Note: Does not include off-site losses
ESA Scope

- Attempt to include some aspects of each of the major areas of focus to facilitate fundamental training, for example:
  - Boiler operations investigations
    - Combustion management
    - Flue gas temperature management
    - Blowdown thermal energy management
    - Other boiler efficiency investigations
  - Resource utilization investigations
    - Primary energy resource management
    - Turbine-PRV management
    - Condensing turbine operations
    - Steam end-use management
  - Distribution system investigations
    - Condensate and flash steam recovery
    - Steam trap management
    - Thermal insulation management.
Technology Replication

Give a man a fish and he will eat for a day.

Teach a man to fish and he will eat for a lifetime.
Summary of identified savings (500 Assessments)

- Total identified source energy savings = 99.7 TBtu per year
- Total identified energy cost savings = $827 Million per year
- Total identified CO2 reduction = 6.92 Million MTons per year
- Total identified natural gas savings >78 TBtu per year
Summary of implemented savings (372 Assessments)

Source energy:
Implemented: 21.1 TBtu/year

Energy cost:
Implemented: >$120 Million/year

Total 372 Assessments
(ESAs with follow-up information)

Based on 6, 12 and 24 months follow-up calls

CO2 reduction:
Implemented: >1.45 Million MTons/year
Plant level overview

Identified savings per plant (2006-2007)

- Average identified source energy savings = 212,021 MMBtu/Plant per year
- Average identified energy cost savings = $1.74 Million per plant per year
- Average identified CO2 reduction = 14,867 Metric Tons/plant per year
- Average % source energy savings identified = 5.94% per plant per year

Total 440 Assessments (ESAs with summary report)
Summary – Identified savings per plant (by system type)

<table>
<thead>
<tr>
<th>System Type</th>
<th>Average Recommended Source Energy Savings (MMBtu/plant per year)</th>
<th>Average Percent Source Energy Savings Recommended (%)</th>
<th>Average Recommended Cost Savings ($/plant per year)</th>
<th>Average Natural Gas Savings Recommended (MMBtu/plant per year)</th>
<th>Average CO2 Savings Recommended (Metric Tons/plant per year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compressed Air</td>
<td>31,270</td>
<td>1.83</td>
<td>$206,717</td>
<td>606</td>
<td>1,829</td>
</tr>
<tr>
<td>Fans</td>
<td>129,109</td>
<td>4.25</td>
<td>$839,262</td>
<td>71,092</td>
<td>7,175</td>
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<tr>
<td>Process Heating</td>
<td>256,549</td>
<td>8.20</td>
<td>$1,829,423</td>
<td>183,965</td>
<td>14,819</td>
</tr>
<tr>
<td>Pumps</td>
<td>36,264</td>
<td>0.97</td>
<td>$178,610</td>
<td>2,748</td>
<td>2,110</td>
</tr>
<tr>
<td>Steam</td>
<td>257,614</td>
<td>6.27</td>
<td>$2,350,689</td>
<td>234,462</td>
<td>20,559</td>
</tr>
</tbody>
</table>
Payback – not the only impediment

- Over 72% of recommended actions had paybacks of less than 2 years.
- 40% of recommended actions had paybacks of less than 9 months.
- Only 9% recommendations had paybacks > 4 years.
Save Energy Now Assessments: 2006-2008

Estimated Payback Periods for Recommended Actions

- **< 9 months**
  - Reduce oxygen content of flue gases
  - Implement steam trap maintenance program
  - Change steam generation conditions

- **9 mo. – 2 years**
  - Change boiler efficiency
  - Change process steam requirements
  - Improve insulation

- **2 – 4 years**
  - Modify steam turbine operation
  - Use variable speed drive
  - Excessive valve friction losses

- **4+ years**
  - Add backpressure steam turbine
  - Install flow pressure control
  - Reduce weight of fixtures, trays, baskets, etc.
US STEEL
Owens Corning

Great example of a company using ESAs to improve energy performance

Company using ESAs as tool to implement corporate commitment to energy efficiency

• Doing ESAs at 15 plants
  – 6 ESAs are cost-shared

• Using ESAs to improve energy use at more than ESA plant
  – Personnel at other plants often sent to ESA plant for training. Attendance as high as 20 people.
Owens Corning

An Example of Success from one of their ESAs

ESA at Newark, Ohio:  (Fans System: March, 07)

• Found $197,200 in potential annual energy savings
  – will cost $277,000 to implement the projects
  – 16 month payback

• 12 opportunities reviewed & analyzed during ESA
  – Due to the ESA success, OC decided to target 7 more areas (on their own) in the future
  – Side bonus--participants identified 11 safety issues
**Owens Corning** — (quotes from OC Newsletter)

**ESA at Newark, Ohio:**

- "The DOE training and tools gave a whole new meaning to waste when I saw the energy excess used on some fans or how they were set up to run," said Bill Cooper, Newark Process Area Leader. "It was very eye opening! I can't wait to use some of the other DOE tools on other processes such as pumps or motors."

- “Plant energy leaders at the event plan to take what they have learned and apply it at their plants to find additional energy-savings opportunities.”
Save Energy Now Assessment Recognition Program

• Rewards companies that implement energy-saving technologies and practices identified through the assessments to achieve a high level of energy efficiency

• Awards to date:

43 Energy Champion Plants:  Saved > 250,000 MMBtu or 15% total energy use

85 Energy Saver Plants:  Saved > 75,000 MMBtu or 7.5% total energy use

Companies include:
- Alcan Packaging
- Dow Chemical
- Northrop Grumman
- International Paper
- Saint-Gobain
- BASF
- Huntsman
- Black & Decker
- US Steel
- Ocean Spray
- DuPont
- Earthbound Farm
Issues to Consider Prior to Applying

- Company Policy regarding payback periods of new projects and budget priorities.
- Engagement of upper management necessary to move forward.
- Recent changes in the company policy emphasizing energy reduction (good time to get involved).
- Flexibility regarding operational changes and downtime.
- Limitations of the current available technology or design.
- Manpower issues (unions, lay-offs, early retirements, etc.).
- Pending mergers, divisions, etc.
- Manpower to implement new projects.
How can industry get involved?

- ITP still has assessments available for the rest of 2008
- Website to apply and to get up to date statistics and case studies:
  [http://www1.eere.energy.gov/industry/saveenergynow/assessments.html](http://www1.eere.energy.gov/industry/saveenergynow/assessments.html)
- Other ways:
  - Free resources, including publications and software tools
  - Agree to do a case study (for very successful plants)
  - Recognition Program
Minimal information needed to complete online application:

- Company contact and information
- Address of facility
- Energy use (total facility)
  - Then break out by type/quantity (gas, oil, etc.)
- 3 sets of dates of availability
- Type of assessment desired
- Text box for any other requests/requirements
Reports, etc…..

• Final reports
  – Drafts
  – Public Reports
  – Confidentiality

• Follow-up
  – 3, 6 and 12 months
    • Summary of changes made
    • Other issues which may have developed
Confidentiality and Post Assessment

- Expert provides the Site Lead with the draft Report for review (within 10 days).
- Site Lead provides comments on report and gives the 'ok' for Expert to release the report to DOE only (business confidential).
- Golden sends Site Lead a draft Public Version of the report and asks them to remove ANY information they do not want released and return within 30 days.
- Golden releases plant approved Public Version of report on Save Energy Now website.
Post Assessment

- 6 months, 12 months, and 24 months after the ESA, Site Lead will be contacted by a student from the Industrial Assessment Center to complete a survey about implementation.
- Depending on results of ESA, Site Lead may also be contacted by DOE about being part of the recognition program and/or to ask if they would like to have the ESA written up as part of a case study.
Other Related ITP Activities
Industrial Assessment Centers/Industry Resources

- DOE's 26 university-based Industrial Assessment Centers (IACs) conduct plant assessments and train engineering students for careers in industrial energy efficiency
- IACs serve 300 plants per year (under 1 TBtu/yr) and typically identify savings of 8%-10% or $115,000/plant
- Database of 13,500 assessment results: [http://iac.rutgers.edu/database](http://iac.rutgers.edu/database)
State-Level Save Energy Now

A partnership of state energy offices, regional energy efficiency organizations, academia, and private companies with the purpose of:

- Working with the states to establish energy assessment capability and expand on the success of the federal program
- Transferring ITP and other energy efficient technologies to the market
- Reducing carbon emissions through energy efficiency

In FY08, 19 states were selected for the State Industrial Assessment Projects Funding Opportunity.

In FY09 solicitation issued for more states to receive assistance to launch state-level Save Energy Now campaigns. Twelve to sixteen awards are expected.
ITP State Activities Web site

http://www1.eere.energy.gov/industry/about/state_activities/main_map.asp

This Web site contains an assortment of information related to industrial energy use for each state including statistics on industry, economic indicators, and statistics on energy use. The site also includes the following data and contact information by state:

- State Incentives and Resources Database
- Energy Saving Assessments
- Industrial Assessment Center assessments
- Events and Training by State
- R&D fact sheets and successes
States Incentives and Resources Database

A repository of over 2,200 energy incentives, tools, and resources for commercial and industrial managers that are available at the national, state, county, local, utility, and non-profit levels. Sample incentives in the database include:

- Analysis Tools
- Energy Audits
- Loans
- Rebates
- Tax Credits
- Training and Education
- Waived Fees
Partnerships Key to Implementation

DOE is developing partnerships with states, utilities, regional organizations, academia, trade groups, and private companies

- Transfer energy-efficient technologies to the industrial market
- Reduce carbon emissions through energy efficiency

**Government Partners**

- NIST, U.S. Dept. of Commerce, Manufacturing Extension Partnership
- Environmental Protection Agency (Energy Star, Climate Leader, and Green Supplier Network)
- State governments and organizations

**Private Partners**

- National Assoc. of Manufacturers
- Green Grid
- Utilities
- Supply chains