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The Premier Energy Training Workshop and Trade Show for Federal Agencies

A River of Energy Solutions

Steam, Water, and Wastewater Savings Opportunities and Tools

Thomas Wenning – Oak Ridge National Laboratory

Overview

1. Background
2. Energy Saving Opportunities
3. Other Opportunities
4. Useful Tools

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Federal Energy Management Program (FEMP)

"facilitates the Federal Government's implementation of sound, cost-effective energy management and investment practices to enhance the nation's energy security and environmental stewardship."

http://www1.eere.energy.gov/femp/

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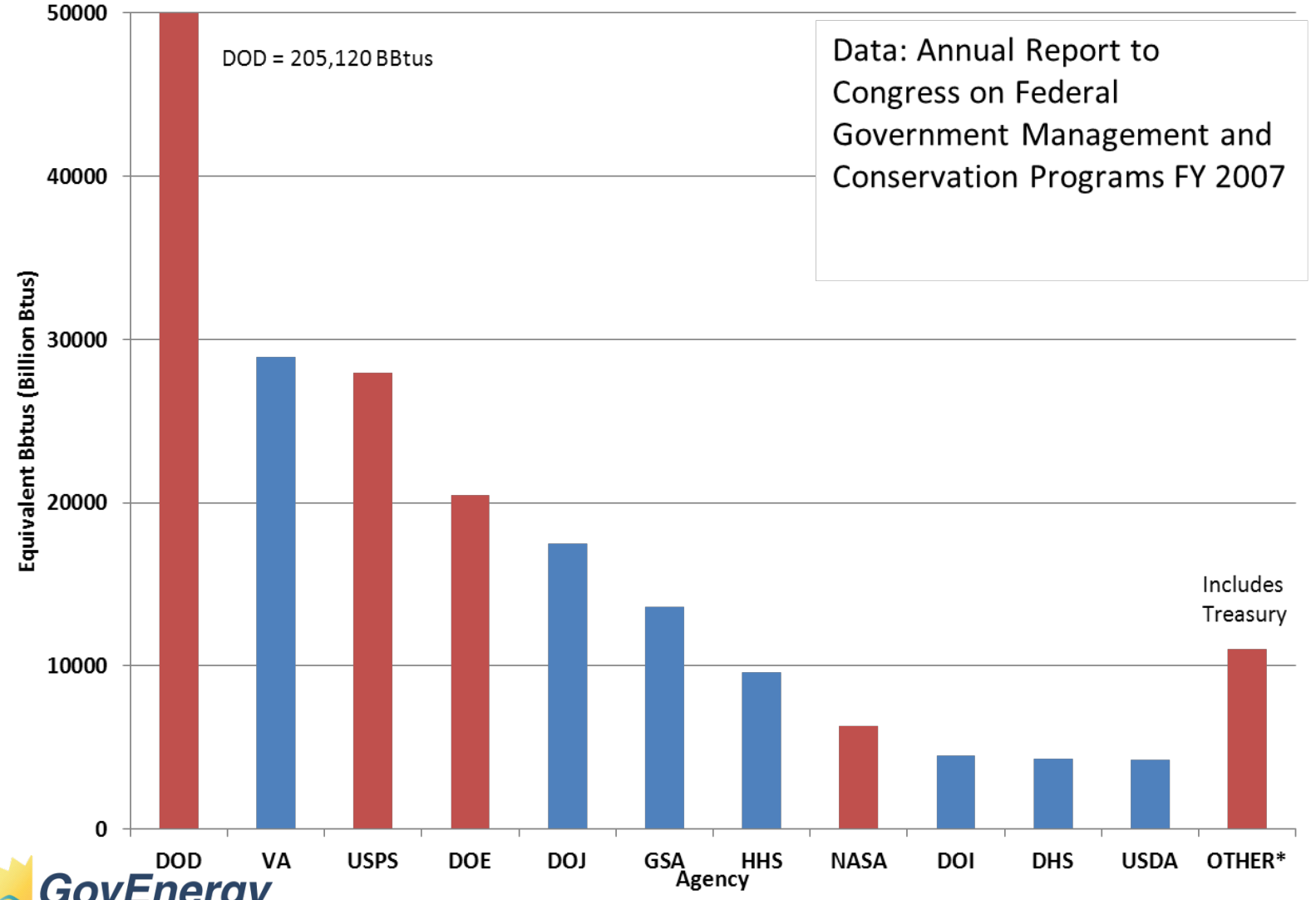
Federal Energy Use by Agency



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Industrial Facilities Initiative (IFI)

- Partnership between DOE's FEMP and Industrial Technologies Program (ITP) began in 2000
- Federal facilities received assessments using the same methodology developed under the Save Energy Now program
- Provided technical expertise from:
  - Oak Ridge National Laboratory
  - Industrial Assessment Centers
  - ITP BestPractices Qualified Specialists

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Industrial Energy Assessments

- Provided entire industrial process assessments
- Targeted system assessments
  - Steam
  - Process Heating
  - Compressed Air
  - Pumps/Fans/Motors (direct drive equipment)
  - Chilled Water
  - Service Water

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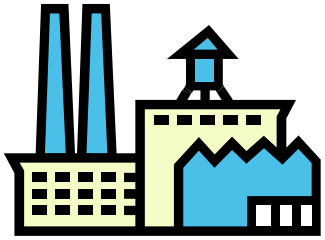
Common System Opportunities…

What are the typical Energy and Cost Saving Opportunities?



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Heating (Steam) Improvements

- Change in Steam Consumption/Conditions
  - Steam Demand Reduction (End Use)
  - Temperature, Pressure
- Dedicated Boiler / Seasonal Shutdown
- Steam Leak and Trap Repair
- Boiler Combustion Control
- Boiler Blowdown
- Condensate Recovery/Return
- Heat Recovery
- Co-generation
- Equipment Upgrades
- Configuration Improvements

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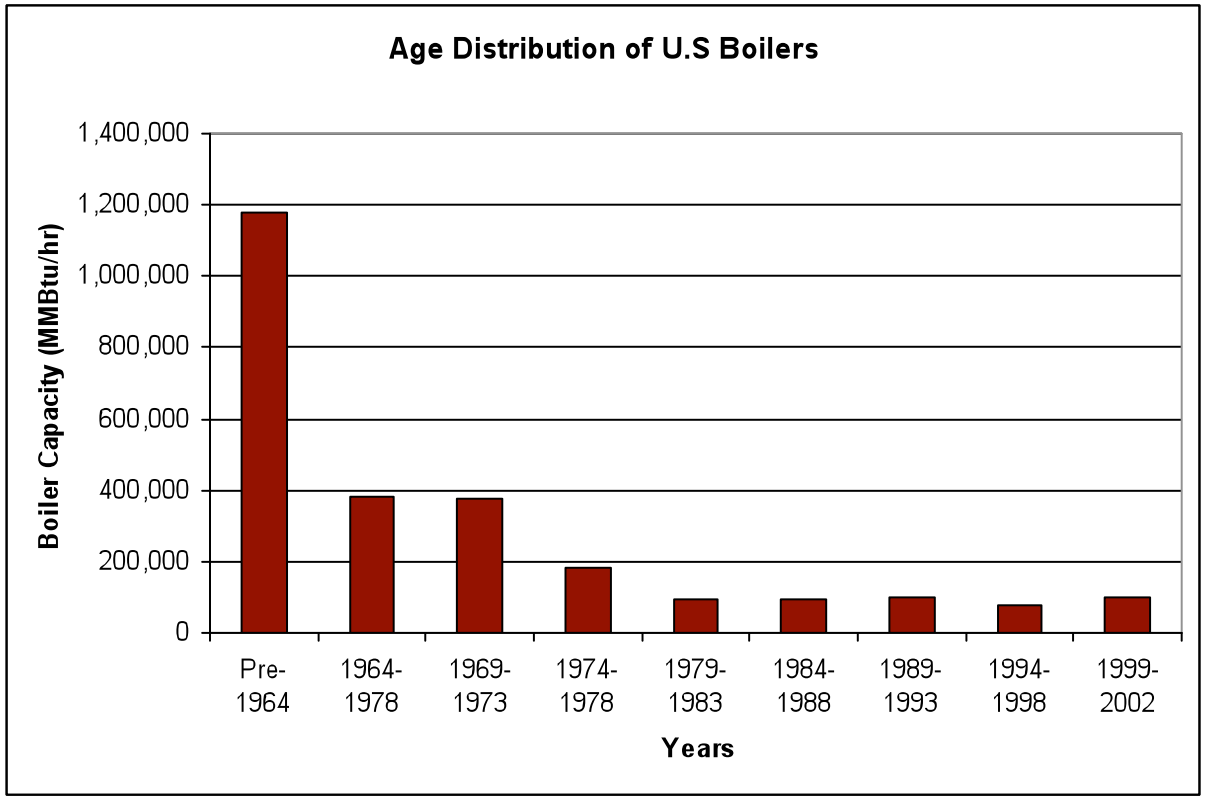
US Boiler Age Distribution
Short Term Savings of 11 TBtu/yr



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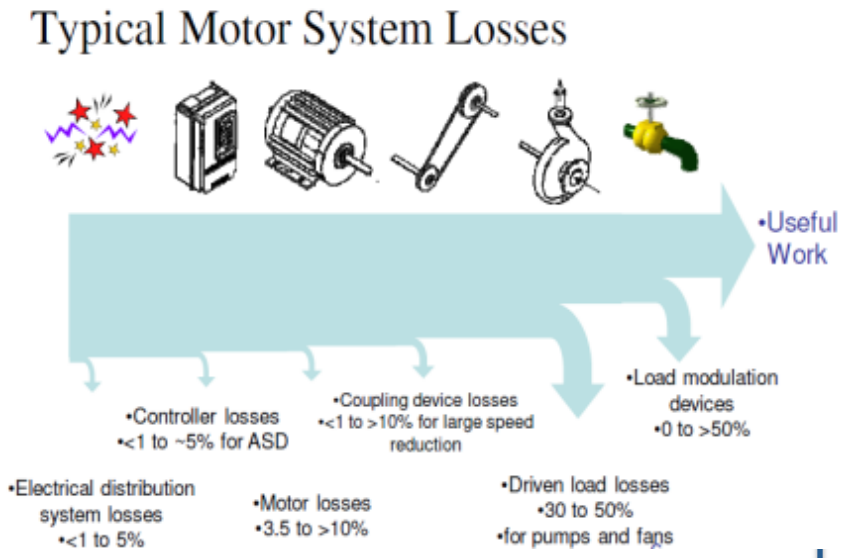
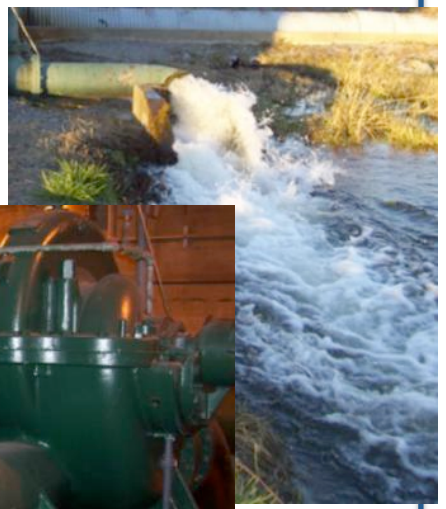
Data: Super Boiler Potential at Federal Sites (Interim Report) - John Shonder

Pumping and Fan Improvements

- "Pump long and pump slow"
  - Reduce pressure
  - Reduce flow
- Utilize most efficient control
  - Variable Frequency Drive (VFD)
  - Inlet Vanes, Outlet Dampers, Throttling Valves
- Optimize System Configuration
  - Right-size pump/fan
  - "System effect"
  - Reduce friction & avoid "T's"
- Use appropriate drive coupling
- Utilize most efficient motors





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General Improvements

- Shut off equipment when not needed
- Preventative maintenance programs
- Insulation
  - Walls
  - Pipes
- Geothermal & River Water

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Other Areas to Investigate

Investigating process and other, more advanced components may provide additional opportunities in industrial areas.

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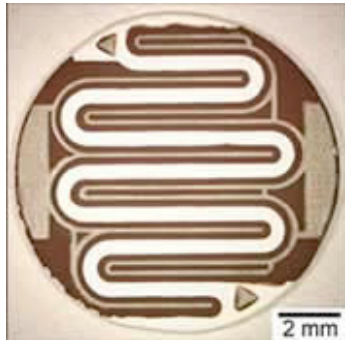
Wireless Sensor Technology

- Reduced installation costs– no wires!
  - $50-$2,000 per foot wiring cost
- Increase Productivity
  - Real-time monitoring of performance
  - Identification of repair needs
- Reduction in Maintenance Costs
  - Easily replaced
  - Remote sensing for hazardous environments
  - Reduces need for manual inspections
- Energy Tracking



Exhaust Gas Sensor
Courtesy of ORNL

http://www1.eere.energy.gov/industry/sensors_automation/pdfs/transformational_wireless.pdf

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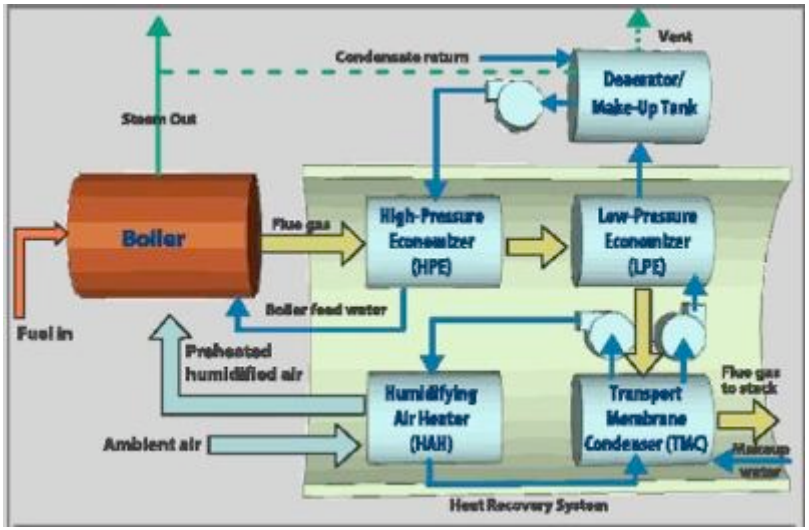
Super Boiler Technology

- What makes it 'Super'?
  - Advanced controls
  - Heat Recovery of Flue Gas
  - Staged and intercooled combustion system
  - Ultra-low emissions



- EERE: 25% increase in steam generation efficiency
  - SuperBoiler is reported at 90-94% efficiency
  - Traditional Boilers are typically mid-80's efficiency

http://www1.eere.energy.gov/industry/combustion/pdfs/superboiler.pdf

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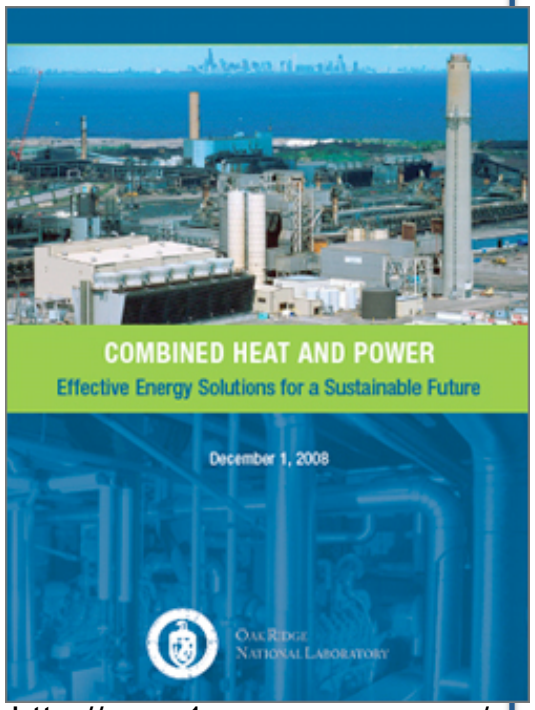
Combined Heat and Power (CHP) – On-Site Generation

- Grid Independency / Energy Security
- Utilize Waste Heat
  - Absorption Chillers
  - Heat Recovery for Steam/Hot Water
  - Heat Recovery for Process
  - Desiccant Dehumidification
- Excess Steam Generation
- Carbon Dioxide Reduction
- Minimizes Distribution Loss
- Alternative Fuels
  - Biomass, Landfill Gas



http://www1.eere.energy.gov/industry/distributedenergy/pdfs/chp_report_12-08.pdf

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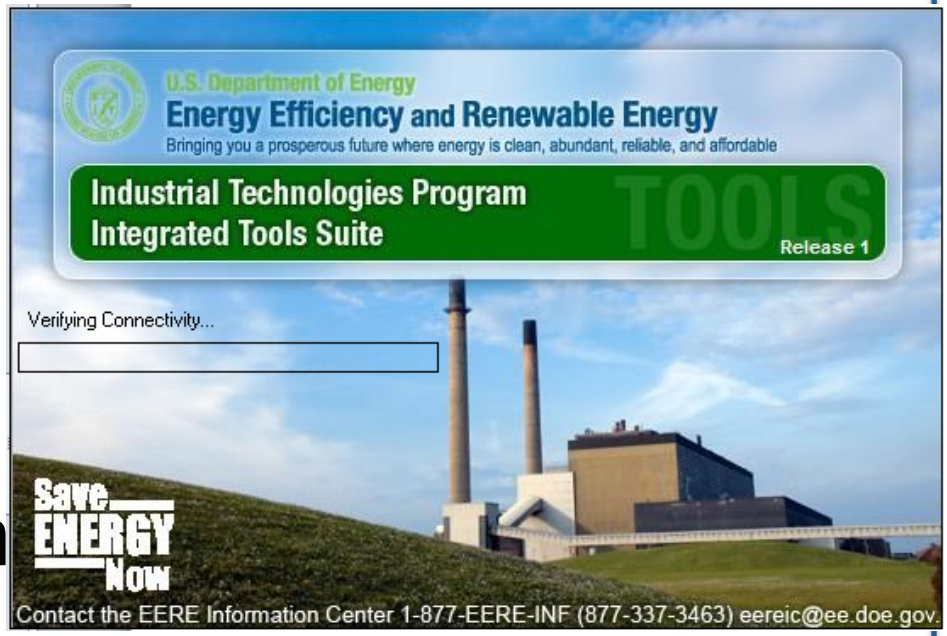
http://www1.eere.energy.gov/industry/distributedenergy/chp_basics.html

System Level Software Tools

- Steam Systems
- Pumping Systems
- Fan Systems
- Chiller Water Systems
- Compressed Air System
- Motor Systems
- Data Centers



http://www1.eere.energy.gov/industry/bestpractices/software.html

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The Steam System Tool Suite

- Steam System Tool Suite consists of three downloadable software tools:
  - Steam System Scoping Tool (SSST)
  - Steam System Assessment Tool (SSAT)
  - 3E Plus

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SSST & SSAT

Steam System Scoping Tool (SSST)

- A scorecard designed to perform initial self-assessments of steam systems to identify areas of improvement
- Evaluate your steam system operations and management against best practices
- Use SSAT to analyze potential projects to consider

Steam System Assessment Tool (SSAT)

- Can develop approximate models of real steam systems
- Contains key features of typical steam systems
- Can quantify the magnitude—energy, cost, and emissions-savings—of potential steam improvement opportunities

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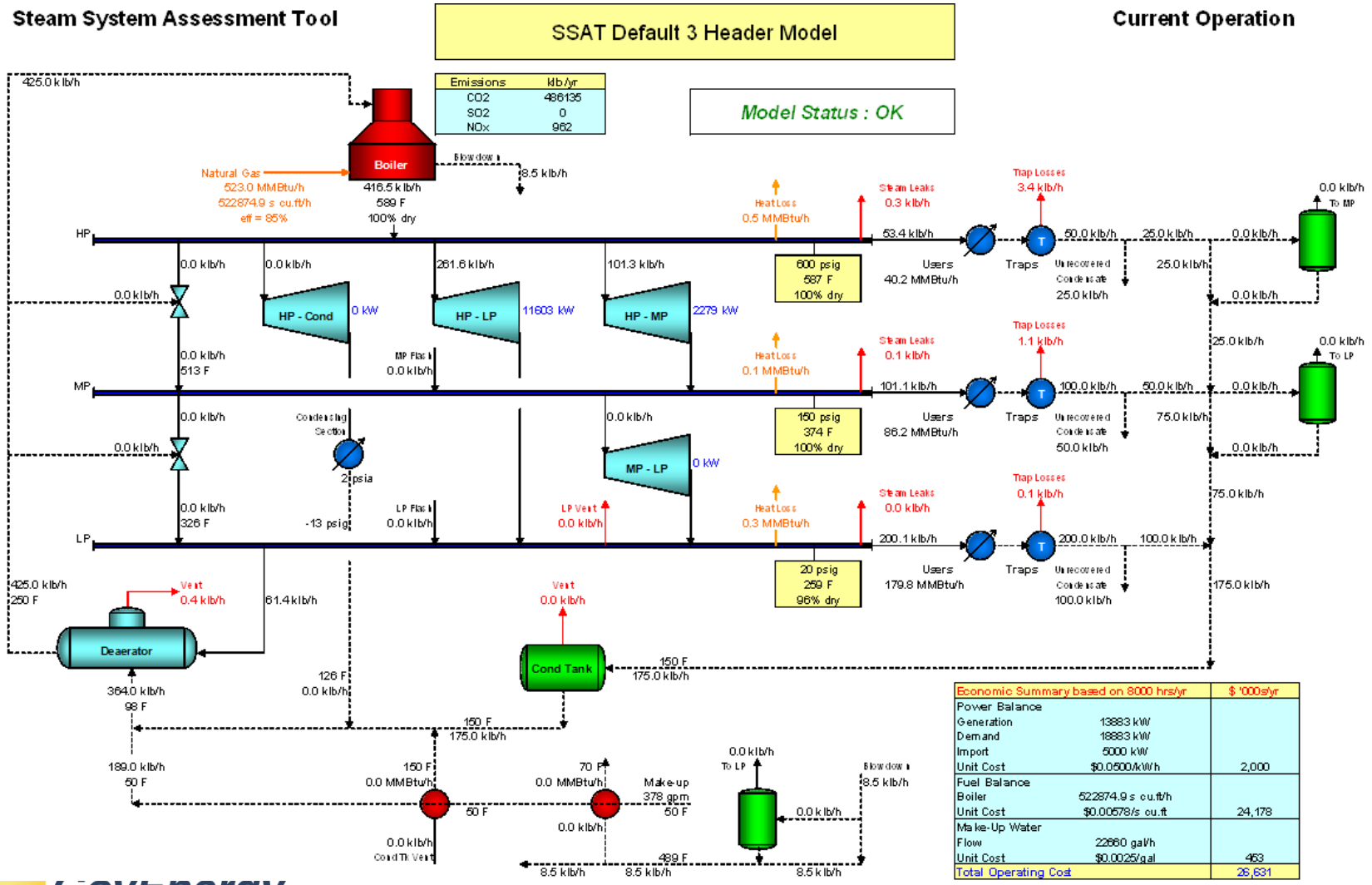
SSAT (cont)



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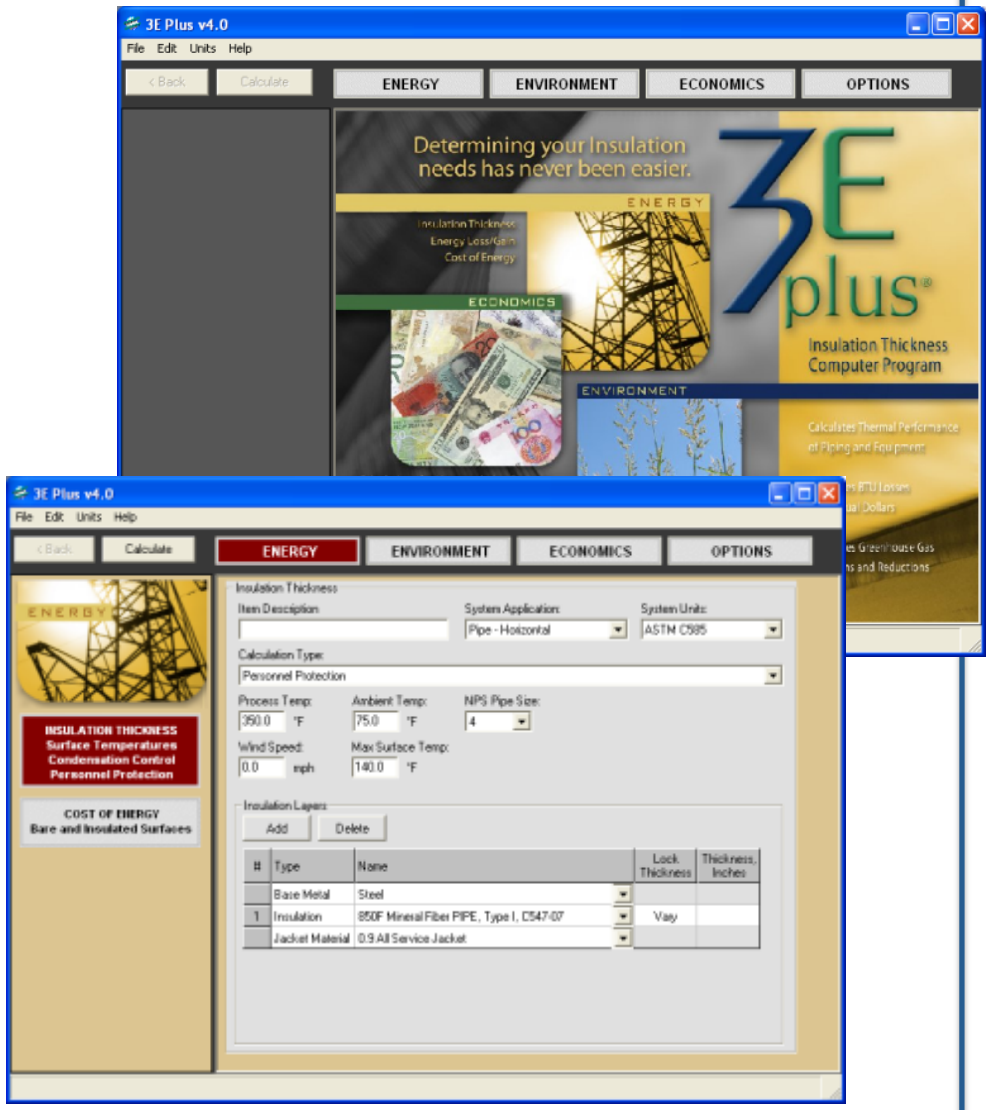
3E Plus

- Calculates the heat loss of various types and thickness of insulation for given operating conditions
- Uses built-in thermal performance relationships of generic insulation materials
- Estimates project cost and emissions savings



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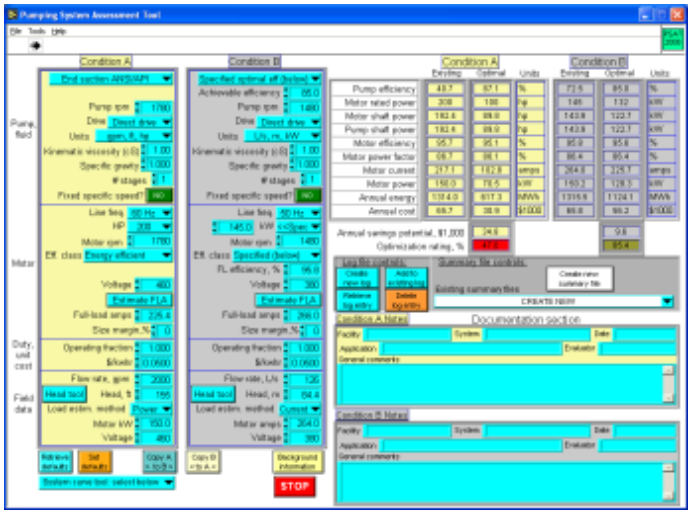
Pumping System Assessment Tool (PSAT)

- Helps users assess efficiency improvements of pumping system operations
- Can calculate potential energy and associated cost savings
- Uses pump performance data from Hydraulic Institute standards



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MotorMaster+

- A motor selection and management tool
- Contains a catalog of more than 20,000 low-voltage induction motors
- Features motor inventory management tools
  - Maintenance log tracking
  - Efficiency analysis
  - Savings evaluation

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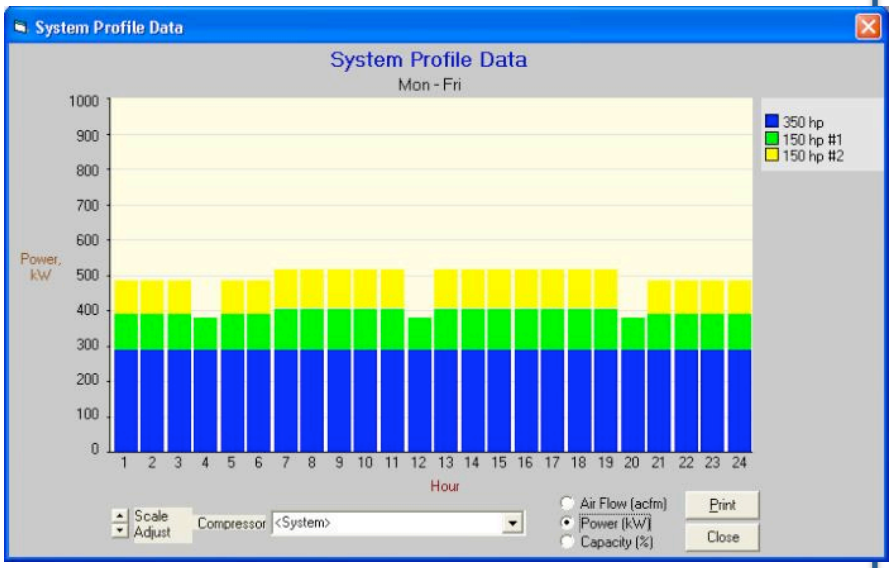
AIRMaster+

- Provides a systematic approach to assessing compressed air systems
- Models existing and future improved system operations
- Can model an unlimited number of interconnected compressors
- Contains database of most commercially available compressors



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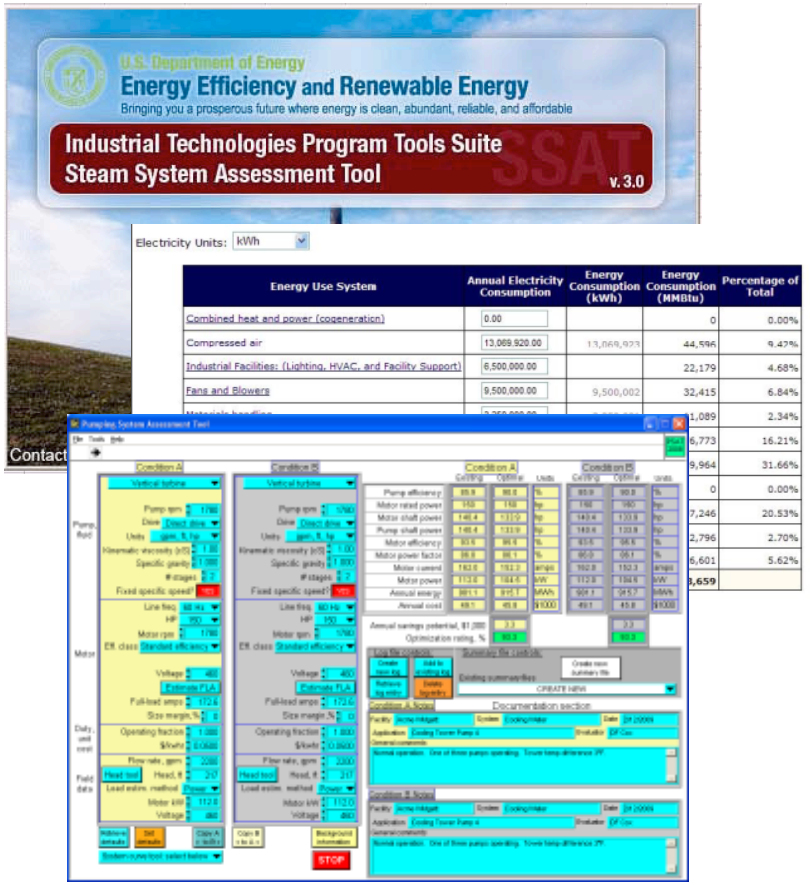
Software Tools

- QuickPep
- Steam System Tool Suite
  - Steam System Scoping Tool
  - Steam System Assessment Tool
  - 3E Plus ® Insulation Thickness Tool
- AIRMaster+ (Compressed Air)
- Pumping System Assessment Tool
- Fan System Assessment Tool
- Process Heating Assessment & Survey Tool
- Industrial Facilities Tool Suite
- Chilled Water System Analysis Tool
- MotorMaster+



http://www1.eere.energy.gov/industry/bestpractices/software.html
http://www1.eere.energy.gov/femp/information/access_tools.html

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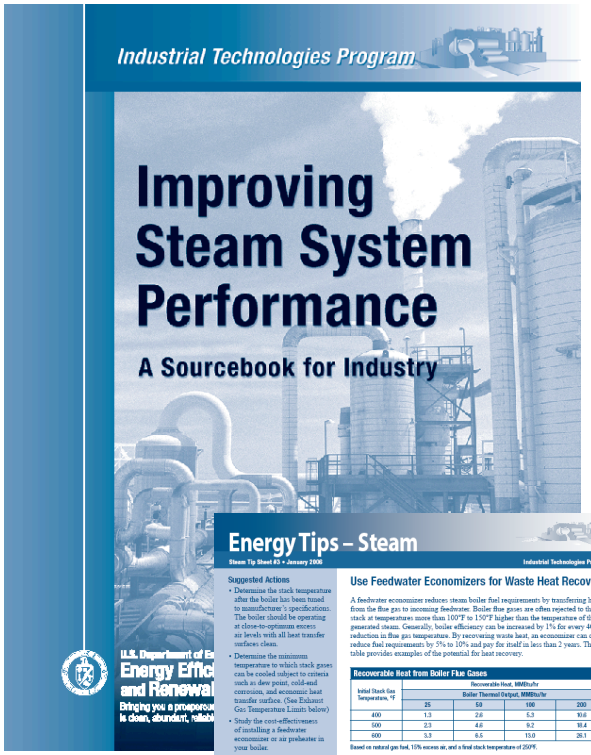
Technical Resources

- BestPractices Publications
  - Handbooks, Sourcebooks
  - Tip Sheets, Fact Sheets
- Training
  - BP Software Tool Introduction Webinars
  - BP End User Training (1-day)
  - BP Qualified Specialist Training (3-day)



http://www1.eere.energy.gov/industry/bestpractices/resources.html

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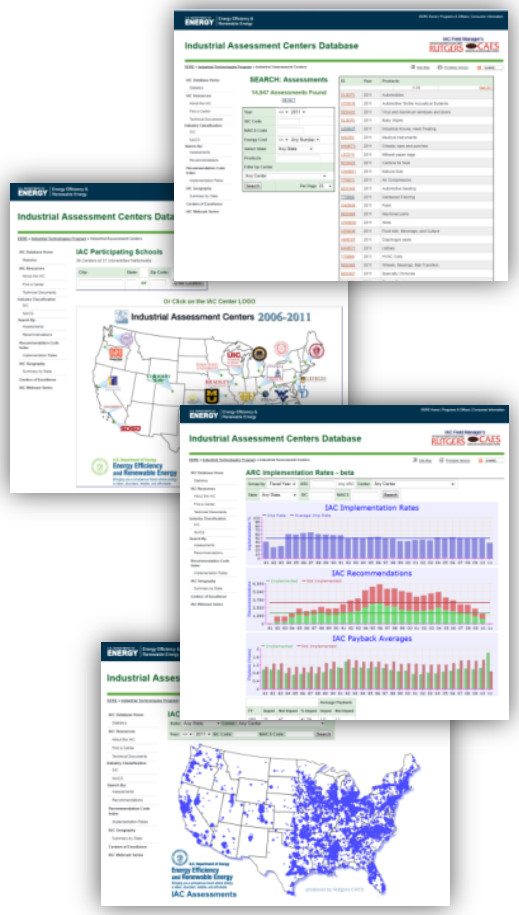
IAC Online Database System

- Collection of publicly available assessment and recommendation data
- Contains ~15,000 Assessments
- Access to:
  - Assessments results
  - Energy and cost savings by recommendation
  - Recommendation statistics
  - Case studies
  - Technical documents



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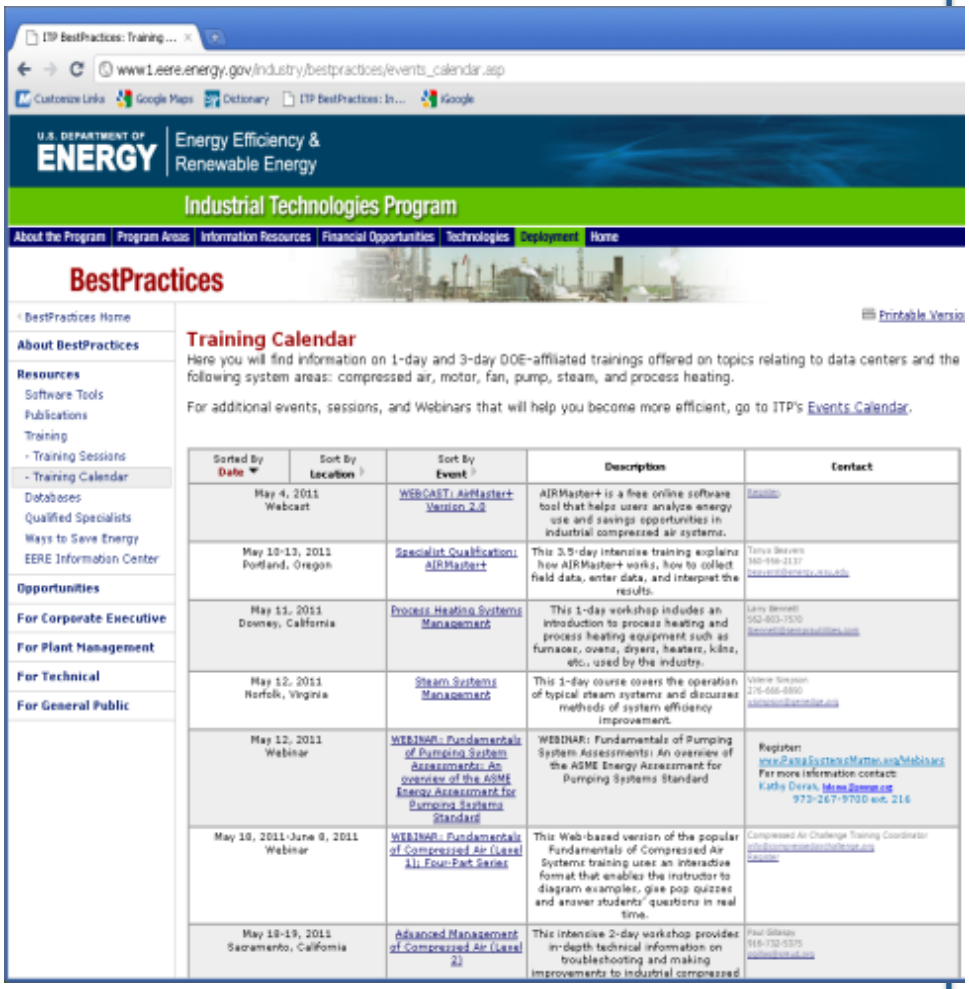
http://iac.rutgers.edu/database/

Observations from Industry: Building Internal Capacity

- Seeing industries and organizations use DOE training to build internal capacity
- Assemble traveling teams to perform assessments
- Rely on DOE available tools and training



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Questions?

Thank-you

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