US DOE Industrial Steam BestPractices Software Tools

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Agenda

• Introduction

• Steam System BP Tools Suite
  – SSST
  – SSAT
  – 3EPlus

• Q & A
Steam System Management Objective:

Minimize Steam Use, Energy Losses And Most Importantly STEAM COST!!

Steam Market Assessment Takeaways

- Fuel savings estimates – individual projects – ranged from 0.6 percent to 5.2 percent

- Estimated payback periods generally very attractive
  - Ranged from 2 to 34 months
  - Most less than 2 years

- Potential steam savings in target industries – over 12 percent of fuel use
Promising Areas To Achieve Steam Energy and Cost Savings?

Use Steam System Scoping Tool (SSST) For Initial Assessment

Generation, Distribution, End Use, Recovery
Steam System Scoping Tool (SSST)

- Software designed to develop awareness of potential steam opportunities

- Major tool worksheets
  - General data
  - Profiling data
  - Total system operating practices
  - Boiler plant operating practices
  - Distribution, End Use, Recovery system operating practices
  - Summary evaluation

Two SSST Formats Available

- Excel Spreadsheet (Version 1.0d)
  - Linking capability across plants
  - Spreadsheet – Look and Feel
  - Manual entry of scores

- Visual Basic (Version 2.0.0)
  - Radio buttons – software package look and feel
  - Automatic entry of scores
Demonstration

Steam System Scoping Tool
Version 2.0.0
December 2002
United States Department of Energy

Click anywhere on this frame to begin the assessment.

Steam System Assessment Tool (SSAT)

• A Steam System Opportunity Assessment Tool

• Produces mass, energy, and economic balances for a steam system

• Completes evaluations of energy utilization improvement projects

• Version 3.0.0 now available
  – Metric (SI units) capability
Key SSAT Features

- Choice of 1, 2, or 3 Header Pressure Models
- Schematics of Model Steam Systems
- Estimates of Site & Global Environmental Emissions
- Major Equipment Simulated:
  - Boiler
  - Back-pressure turbines
  - Condensing turbine
  - Deaerator
  - Steam traps, leaks, insulation losses
  - Letdowns
  - Flash vessels
  - Feedwater preheat exchangers

SSAT Can Evaluate Key Steam Improvement Projects

- Steam Demand Changes
- Boiler Efficiency
- Alternative Fuels
- Steam Turbines vs PRVs
- Boiler Blowdown
- Condensate Recovery
- Heat Recovery
- Flash Steam Recovery
SSAT Worksheets

- **Input**
  - Builds the model
- **Model**
  - Graphical representation of the system
  - Base case
- **Projects Input**
  - Allows projects to be activated
  - Allows custom project operation
- **Projects Model**
  - Graphical representation of the system
  - The modified system
- **Results**
  - Side-by-side comparison of the major system operating factors
- **Stack Loss Calculator**
  - Calculate boiler stack losses for SSAT fuels
- **User Calculations**
  - Open worksheet to allow individual calculations

Demonstration

Steam System Assessment Tool

This tool was developed for the U.S. Department of Energy under contract with the Oak Ridge National Laboratory by KBC Linhoff March and Spirax Sarco Inc.

Technical Support provided by Dr. Greg Harrell, University of Tennessee / Knoxville, Energy, Environment and Resources Center
SSAT “Help” Available

Insulation

• Safety
  – Comes first and mustn’t be compromised at all
  – OSHA requires surface temperatures to be less than 120-140 °F

• Energy Cost Reduction
  – Reduce fuel cost

• Process & Product Quality Control
  – Temperature requirement
  – Quality of product

• NIA has a certified insulation appraisal training program
Insulation Loss

- Often maintenance repairs result in sections of missing insulation
- As an example, in a 200 psig (400°F) steam system, 10 feet of un-insulated 8 inch pipe will result in:
  - A heat transfer loss of 300 MMBtu/yr
  - $3,600/yr in fuel expenditures
    - $10.00/10^6Btu
    - 80% boiler efficiency

Insulation Tool – 3EPlus

- North American Insulation Manufacturers Association (NAIMA) developed 3EPlus - determines optimum insulation thickness for a wide variety of insulating materials

- Software outputs include:
  - Surface heat transfer loss
  - Insulation surface temperature
  - Simple payback of an insulating project
Economic Insulation Thickness

- Pareto Curves
  - 2-objective problem
  - Maximum of one objective is Minimum of other
  - And vice versa

- Optimize for lowest Life Cycle Cost

3EPlus Insulation Software

- Level of Effort
- Heat Loss/Gain
- Surface Temperature
- Savings Analysis
- Insulation Project
Demonstrating The 3E-Plus Insulation Appraisal Software...

Steam System Survey Guide

- Technical Guide
- Covers 5 Areas:
  - Steam system profiling
  - Identifying steam properties
  - Improving boiler operations
  - Improving resource utilization
  - Improving steam distribution
Steam System Sourcebook

- Includes Three Main Sections:
  - Steam System Basics
  - Performance Improvement Opportunities
  - Programs, Contacts, and Resources

Steam Energy Tips

- 1- Page Tips For Improving Steam System Areas

- Available On BestPractices Web Site, And In Steam Sourcebook
Where to Download the Tools


• Search the internet by Keyword – “DOE Best Practices Software Tools”

Additional Training


• Training Calendar

• Qualified Specialist Program

• EERE Information Center
  – 1-877-EERE-INF (877-337-3463)
  – Email - eereic@ee.doe.gov
• Use the Steam System Scoping Tool to:
  – Do a qualitative assessment of your steam system compared to Best Practices in Industry
  – Identify potential energy cost reduction project areas

• Use the Steam System Assessment Tool to:
  – Model your steam system
  – Complete mass, energy, emissions balance before and after projects
  – Very quickly quantify the economic & environmental impact of one or multiple projects

• Use the 3EPLus software to:
  – Do an assessment of your thermal insulation
  – Identify potential insulation upgrade areas
  – Determine the surface heat transfer loss
  – Calculate insulation surface temperature
  – Determine the thermal cost-effectiveness of the insulation (new or retrofit)
  – Simple payback of an insulating project
Questions & Answers