Steam End User Training
Welcome Module

Slide 1 – Steam End User Training

Welcome to the Department of Energy's Industrial Technologies Program BestPractices Steam End User Training. The Department of Energy does not endorse products, thus the visuals in this training will be vendor-neutral.

[Slide Visual – Steam End User Course Welcome]

Banner:
US Department of Energy
Energy Efficiency and Renewable Energy

US Department of Energy's
Industrial Technologies Program

BestPractices
Steam End User Training

Slide 2 – Course Contents

There are seven different sections in this training. The navigational tutorial will provide you with a brief demonstration on how to navigate through the training. The Introduction will provide you a history of the course development, and then focus on the general aspects of steam system management and investigation. In this section we will introduce the first of the steam system software tools, the Steam System Scoping Tool, or SSST, which provides support in identifying areas of potential improvement. This will prepare you for more in-depth discussions in the forthcoming sections of the training, including utilizing additional software tools from the BestPractices Steam System Tool Suite such as the Steam System Assessment Tools, SSAT, and the 3E-Plus Insulation Tool. The Steam Generation Efficiency module focuses on boiler efficiency. In this section the definition of boiler efficiency will be discussed and the various avenues of boiler losses will be explored. Resource Utilization Effectiveness will discuss fuel selection, steam demands, and cogeneration. The Steam Distribution System Losses module will cover steam leaks, steam traps, insulation issues, and condensate loss. Everything will be wrapped up with the Conclusion. Lastly, there will be an End of Course Quiz, which will evaluate your knowledge and understanding of the training.

[Slide Visual – Steam End User Course Contents]

- **Navigational Tutorial**
- **Introduction - (SSST)**
- **Steam Generation Efficiency - (SSAT)**
  - **Boiler efficiency definition**
  - **Shell, Blowdown, and Stack Losses**
- **Resource Utilization Analysis – (SSAT)**
  - **Fuel selection**
  - **Steam demands**
  - **Cogeneration**
- **Steam Distribution System Losses - (3E-Plus)**
  - **Steam leaks**
  - **Steam traps**
  - **Insulation issues**
  - **Condensate loss**
- **Conclusion**
- **Quiz**

Slide 3 – Steam Assessments

This course is structured like a typical steam system assessment. The assessment is designed to investigate the performance characteristics of the system, point out best practices, identify opportunities to improve performance, and evaluate the economic impact of potential improvements. This training will provide an overview of typical steam systems, their components, operating principles, management techniques, and potential improvement opportunities.

Steam system modifications often affect the entire system requiring complicated calculations to accurately evaluate mass, energy, and economic impacts. This course will point out the various tools we have available to us in the investigation process. Many of the tools are the fundamental principles of physics that allow us to identify the "before" and "after" conditions associated with a specific modification. Additionally, the U.S.DOE has developed a sophisticated set of tools that enhance our ability to accurately and effectively evaluate steam system modifications. We will discuss these free tools that complete complicated calculations and help you identify, analyze, quantify, and prioritize energy savings within your plant's steam system.

Slide 4 - Steam System Schematics

We will use an example steam system to serve as the focus of our in-class steam system assessment. The example steam system represents a heavy industry site with typical components and common operating conditions. The evaluations and findings noted in this training represent opportunities

commonly identified in industrial steam system investigations. This steam system is not extraordinary in any manner including fuel cost, steam production, and operating conditions.

As you will see, the example system operates with three boilers—each boiler consumes a different fuel (natural gas, number 6 fuel oil, and green wood). The total fuel expenditure for the site is nominally 19 Million Dollars per Year. Typical steam production is 260,000 pounds per hour of 400 psig, 700 degree Fahrenheit superheated steam.

The three boilers deliver high pressure steam to the distribution system header. High pressure steam serves steam loads, as well as several cogeneration components. The backpressure turbines are connected to electrical generators, thus serving to reduce steam pressure and to generate electricity. Pressure reducing stations also assist in managing the flow of steam through the system.
As in all steam systems there are many auxiliary components such as condensate recovery tanks, makeup water treatment equipment, deaerator, feedwater pumps, and many more components not shown in the schematic.

> ***[Slide Visual – Steam System Schematic]***
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> **This schematic represents a three-header steam system incorporating three boilers and many system components. The steam distribution system includes three back pressure turbines and two pressure-reducing valves. The turbines and pressure-reducing valves operate between the various steam pressures of the system. Each steam header includes end-use steam loads which discharge condensate through steam traps to their respective condensate collection tanks. Condensate is ultimately collected in the main condensate receiver, then pumped to a deaerator. The deaerator also receives makeup water and steam to preheat the collected condensate and makeup water. The deaerator outflow becomes the feedwater for the boilers.**

<u>Slide 5 – Results</u>

The example system, which is based on a real-world steam system, was subjected to a steam system assessment using fundamental investigation techniques and the U.S.DOE Steam Tools. The assessment identified several projects that will result in significant energy savings that present economically attractive projects. The assessment identified more than $1,300,000 per year of energy savings, which represents more than 7 percent of the fuel input cost to the site.

This Steam End User Training will walk you through this real-world example of a steam system to help illustrate how you can identify areas with potential for saving energy and for reducing costs.

Now, let's get started so you can learn how to identify energy efficiency improvements at your site!