Welcome Module

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Slide1: **Steam System Tool Suite -** Welcome to the Steam System Tool Suite training.

Slide 2: There are eight different sections in this training. The navigational tutorial will provide you with a brief demonstration on how to navigate through the training. Then, you will learn how to use each one of the tools in the suite, including the Steam System Scoping Tool, the Steam System Assessment Tool, and the 3E Plus Insulation Tool. Each one of these trainings is called a module, and each module is followed by an interactive quiz, which will test your knowledge of the tools. Lastly, everything will be wrapped up with the conclusion.

Slide 3: **Tool Capabilities -** The U.S.DOE Steam Tools are designed to aid in assessing steam systems by identifying areas to investigate. The tools are most powerful in evaluating the opportunities to improve steam system operations by determining the energy and economic impact of specific projects. Steam assessments identify the performance characteristics of the system and identify opportunities to improve performance. Steam system modifications often affect the entire system requiring complicated calculations to accurately evaluate mass, energy, and economic impacts. The U.S.DOE Steam Tools complete these complicated calculations.

In this training you will learn the basics of how to use the tools to identify, analyze, quantify, and prioritize energy savings within your plant's steam system.

Slide 4: **Example Steam System -** The training will use an example steam system to demonstrate the use of the tools. The steam system used as the example 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.

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. The cost of natural gas is ten dollars per Million BTU, the cost of number 6 fuel oil is five dollars per Million BTU, and the cost of green wood is 2 dollars per Million BTU (the blended fuel cost is five dollars and 80 cents per Million BTU). Typical steam production is 260,000 pounds per hour.

Slide 5: **Steam System -**

Schematic Visual Description:

Three boilers in parallel configuration produce steam to a multi-header steam distribution system with three pressure levels, high-pressure steam, medium-pressure steam, and low pressure steam. The schematic details are as follows:

Fuel is supplied to each boiler separately, as each has a separate fuel source.

A feedwater supply header provides feedwater to each of three steam boilers. Each boiler produces steam to supply a main high-pressure steam header.

The high-pressure steam header feeds a high-pressure distribution system with two backpressure turbines, one pressure reducing valve, and the high-pressure steam load (end users). The first backpressure turbine receives high-pressure steam and reduces it to low-pressure steam while generating electricity. The next item on the high-pressure distribution system schematic is the pressure reducing valve (PRV) which reduces the steam to medium-pressure. The second backpressure turbine receives high-pressure steam and reduces it to medium pressure steam while generating electricity. The final items on the high-pressure steam distribution system schematic are the end users, represented as a heat exchanger. Condensate discharged from the heat exchanger passes through a steam trap and is then directed to a flash-vessel allowing the condensate to from flash steam that is directed to the medium-pressure header. The remaining condensate exits the flash-vessel and is directed to the condensate recovery flash-vessel that discharges flash-steam to the low-pressure header.

The medium-pressure steam header supplies steam to one backpressure turbine which reduces steam to the low-pressure steam header while generating electricity. The medium-pressure header also supplies a pressure reducing valve which reduces steam to the low-pressure steam header. The medium-pressure header also supplied steam to the medium-pressure steam load, which is represented as a heat exchanger. This heat exchanger is represented similarly to the high-pressure unit. The heat exchanger discharges condensate through a steam trap to a flash-vessel that allows the condensate to form flash-steam that is directed to the low-pressure header.

The low-pressure distribution header receives steam from the turbine exhausts, the PRV station, and the flash steam generated from the condensate system. The low-pressure header supplies steam to the low-pressure load, which is also represented as a heat exchanger. This heat exchanger discharges condensate through a steam trap. The condensate enters an atmospheric pressure flash-vessel and is then pumped to the main condensate receiver where it combines with the condensate from the other end-use components. Low-pressure steam is also supplied to the deaerator through a control valve.

The main condensate tank pumps the combined collected condensate to the deaerator. Make-up water is mixed with the condensate prior to entering the deaerator. Feedwater is pumped from the deaerator to a header to supply the boilers, thus completing the schematic loop.

Cogeneration components are in place in the form of backpressure turbines. One of the backpressure turbines is in-place receiving high-pressure steam and discharging medium-pressure steam. This unit is rated to produce 3,500 kilowatts of power. Another backpressure turbine is in-place receiving medium-pressure steam and discharging low-pressure steam. This unit is rated to produce 4,200 kilowatts of power. The third backpressure turbine is a smaller capacity unit receiving high-pressure steam and discharging low-pressure steam. This unit is rated to produce 750 kilowatts of power. Steam is distributed to users at high, medium, and low pressures.

Slide 6: **Results -** The example 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 dollars per year of energy savings, which represents more than 7 percent of the fuel input cost to the site.

This Tool Introduction 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 utilize these tools at your site!