Stack Economizer Savings Calculations
For Process Boiler Measure #1 Non-Condensing Stack Economizer Requirement

Savings were calculated based on the improved combustion efficiency resulting from the stack temperature drop across the economizer. The boiler load was calculated using annual energy input and boiler efficiency. The boiler load was kept constant and divided by post boiler efficiency to estimate future energy input.

BE = combustion efficiency – shell losses

- BE = boiler efficiency
- CE = Combustion efficiency

1) **Calculate baseline and post- combustion efficiency** using the ASME PTC-4 Indirect Method: Stack Loss Method
    a. Temperature drop across stack economizer: 80°F

2) **Calculate boiler load** based on gas consumption and boiler efficiency

$$\text{Boiler Load} = \frac{\text{Annual Gas Consumption}_{\text{Baseline}}}{\text{Boiler Efficiency}_{\text{Baseline}}}$$

3) **Calculate proposed boiler gas consumption** based on boiler load and boiler efficiency

$$\text{Annual Gas Consumption}_{\text{Post}} = \frac{\text{Boiler Load}}{\text{Boiler Efficiency}_{\text{Post}}}$$

4) **Calculate difference in baseline and proposed gas consumption** to get energy savings

$$\text{Savings} = \text{Annual Gas Consumption}_{\text{Baseline}} - \text{Annual Gas Consumption}_{\text{Post}}$$

Assumptions:

Consistent between baseline and measure case:

1. Boiler operation: 6,500 hrs/yr
2. Shell losses: 1%
3. Combustion air temperature: 75°F
4. Stack O_2: 7.1%

Unique to baseline case:

1. Boiler efficiency: 79.5%
2. Combustion efficiency: 80.5%
3. Stack exhaust temperature: 382°F

Unique to proposed measure case:

1. Boiler efficiency: 81.8%
2. Combustion efficiency: 82.8%
3. Stack exhaust temperature: 302°F
4. Economizer heat transfer effectiveness: 95%