

Stack Gas Economizers

Situation Overview

Boilers, both hot water and steam, are the basic form of heating in many commercial and industrial facilities. Applications range from HVAC heating to hot water heating for manufacturing processes and account for significant energy use and costs. Flue gas economizers can increase boiler thermal efficiency by recovering exhaust gas waste heat. Benefits include:

- Increasing boiler efficiency by as much as 10 percent.
- Reducing harmful emissions such as CO₂, NO_x, SO_x, etc.

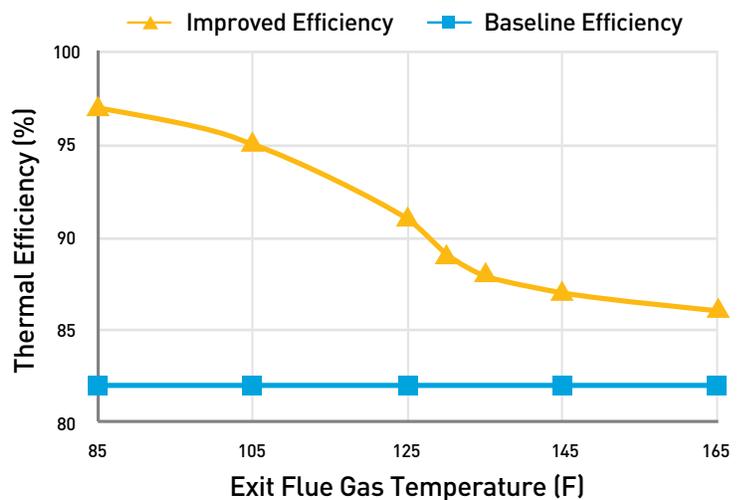
Technology Overview

Condensing economizers recover heat stored in exhaust flue gases that would otherwise be wastefully exhausted into the atmosphere. This design is an addition to traditional (non-condensing) economizers that only reduce the exhaust gas temperature to above its dew point to avoid condensation and the resulting corrosion. They are an excellent energy- and cost-savings solution for facilities using hot water or steam for process heating.

Field Study Results

Many in-field case studies compare performance of boilers equipped with condensing economizers to those without them. Parameters include inlet and exit flue gas temperatures, flue gas mass flow rate and the system's total efficiency.

Findings show efficiency increases as exit exhaust temperature decreases. The decrease depends on the heat sink available at the facility. At 105 degrees Fahrenheit, the thermal efficiency can be increased to 94 percent.



EFFICIENCY WITH AND WITHOUT CONDENSING ECONOMIZER



Savings Summary and Incentives

The table below provides an estimated annual savings and potential PG&E incentive for installing a condensing economizer on an existing boiler (without economizer). The analysis is based on the following assumptions:

- Incentive amount \$1/Therm
- Project type is retrofit add-on
- Average load factor is 70 percent
- Boiler thermal efficiency without economizer is 82 percent
- Annual operating hours of 4,380 hours
- Excess air of 15 percent for efficient combustion
- Economizer flue gas inlet and exit temperatures are 450 and 105 degrees Fahrenheit respectively
- Gross measure cost is based on available case studies
- Incentives are capped at 50 percent of full measure cost

| Rated Boiler Size (MMBtu/hr) | Annual Gas Savings (Therms) | Annual Energy Cost Savings (\$) | Gross Measure Cost (\$) | Estimated Incentive (\$) |
|------------------------------|-----------------------------|---------------------------------|-------------------------|--------------------------|
| 10 | 59,163 | 47,330 | 100,000 | 50,000 |
| 15 | 88,744 | 70,995 | 150,000 | 75,000 |
| 25 | 147,907 | 118,326 | 250,000 | 125,000 |
| 50 | 295,815 | 236,652 | 500,000 | 250,000 |
| 100 | 591,629 | 473,303 | 1,000,000 | 500,000 |
| 150 | 887,444 | 709,955 | 1,500,000 | 750,000 |
| 200 | 1,183,258 | 946,606 | 2,000,000 | 1,000,000 |

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