

Economizers and Turbulators

... or “Why haven’t we done this already?”

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Focus Group



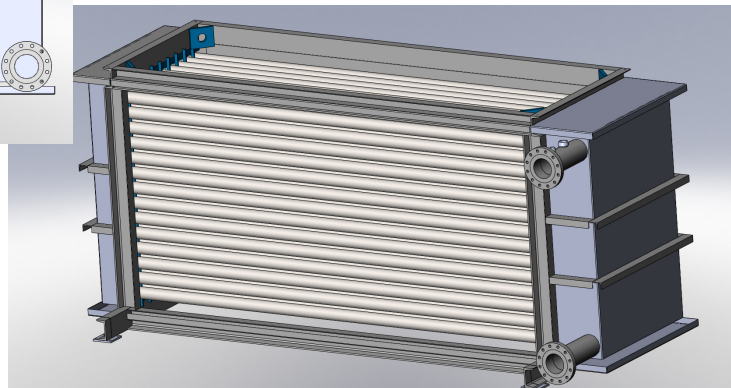
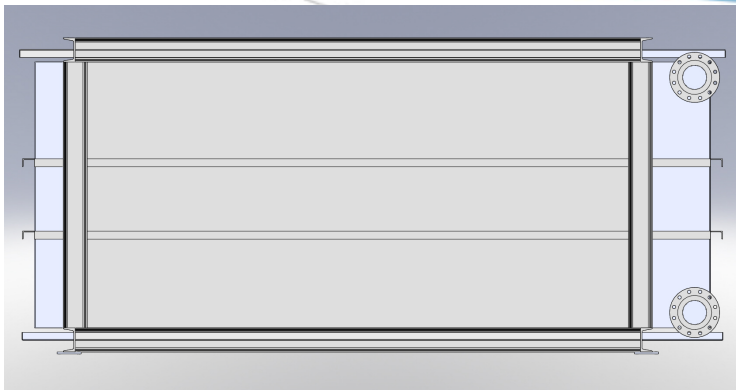
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Why an economizer?



What is an economizer?



Custom configurations



Design variables

- ◆ Pressure drops

- ◆ Water

- ◆ Gas

- ◆ Fins

- ◆ Type

- ◆ Density

- ◆ Material

An investment with a measurable return



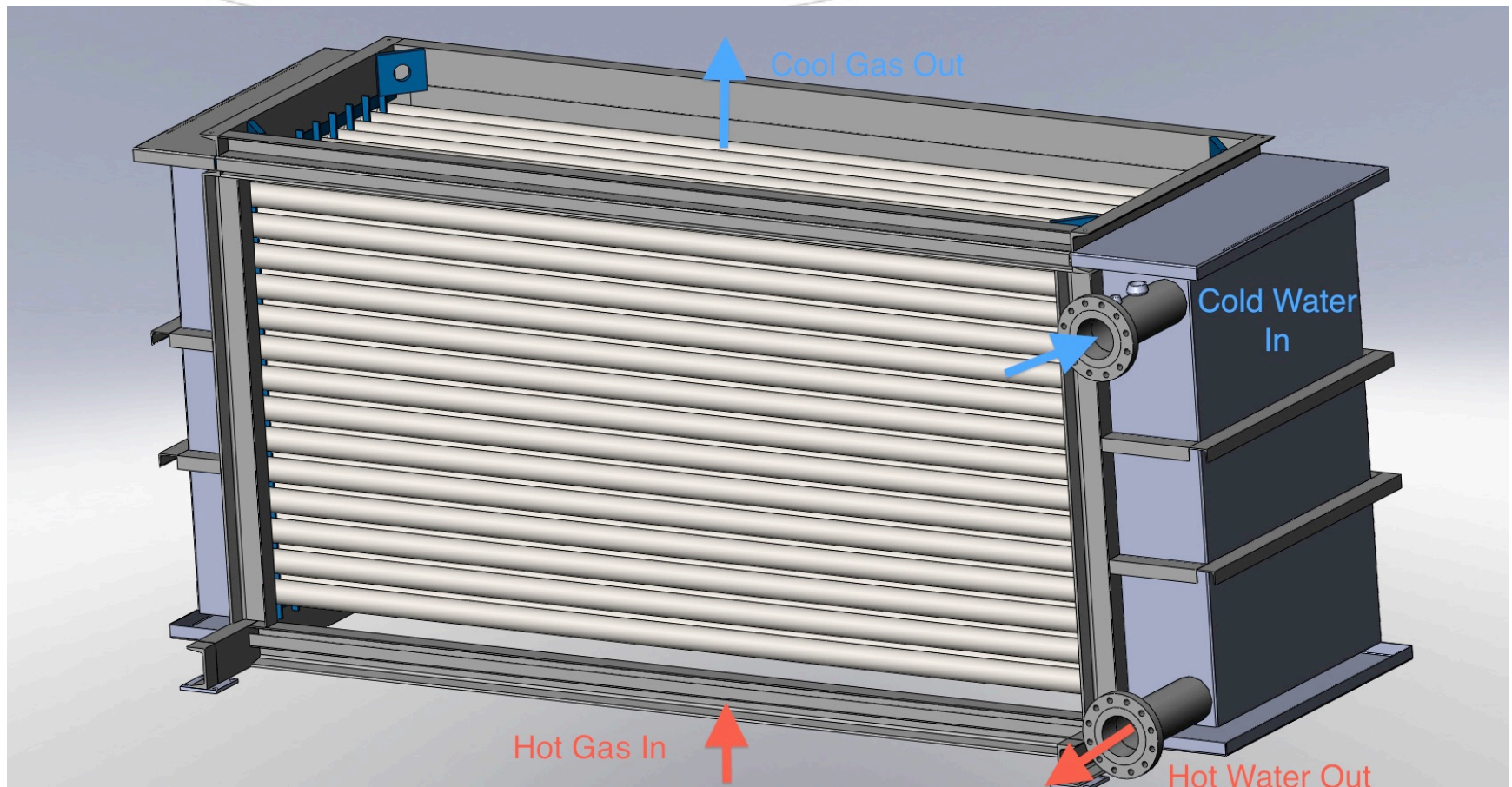
$40^{\circ}\text{F} \approx 1\%$

- ◆ $250 \text{ mmbtu/hr} * \$5/\text{mmbtu} * 8000 \text{ hr/year} = \$10,000,000$
- ◆ Reduce flue gas temperature from 620°F to 300°F
- ◆ $(620 - 300)/40 = 8\%$
- ◆ $8\% \approx \$800,000$ in fuel savings annually
- ◆ Fuel consumption is reduced by $\sim 160,000$ mmbtu/year
 - ◆ GHG emissions reduction is equivalent
- ◆ Your mileage may vary...

Condensing economizers



The nuts and bolts



Can we condense?

- ◆ Fuel(s)?
 - ◆ Sulfur is a real challenge.
- ◆ Material Selection?
 - ◆ Tubes must be stainless steel
 - ◆ Oxygen pitting from the inside
 - ◆ Corrosion from the outside
- ◆ Heat Sink?

What do I do with the heat?

- ◆ High condensate return = Low levels of cold, makeup water
- ◆ Is there another process where hot water, glycol or heat transfer oil make sense?
 - ◆ Can the other process accept the load swings of the boiler?

What do I do with the water?

- ◆ Flue gas temperatures of 140°F and above:
 - ◆ Water will condense on tubes but typically re-entrain and be carried out the stack
- ◆ Flue gas temperatures below 140°F:
 - ◆ Rain
 - ◆ Drainage system required.
 - ◆ Water disposal to drain or to deaerator for treatment

3 Questions

- ◆ Is my fuel sulfur-free?
- ◆ Do I have a place to put the heat?
- ◆ Do I have a way to handle the condensate?
 - ◆ 250,000 lb/hr of flue gas has ~60 gpm of water available to condense in a natural gas fired system

Economizers – the bottom line

- ◆ If your boiler operates more than 700 hours/year, you should have an economizer.
- ◆ If you change your fuel, evaluate your economizer.
- ◆ If you are wondering if a condensing economizer makes sense, ask.
- ◆ Economizers are an effective way to control the flue gas temperature for optimal pollution control equipment operation.
- ◆ ...but we are not quite finished...

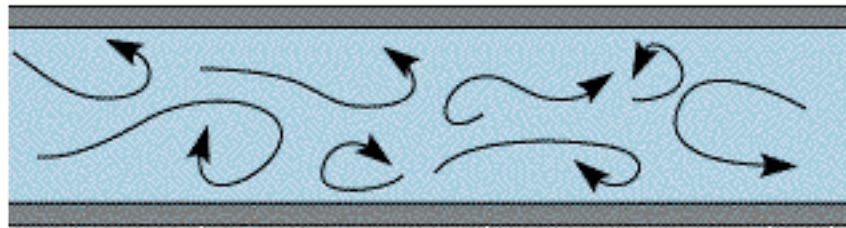
Firetube boilers



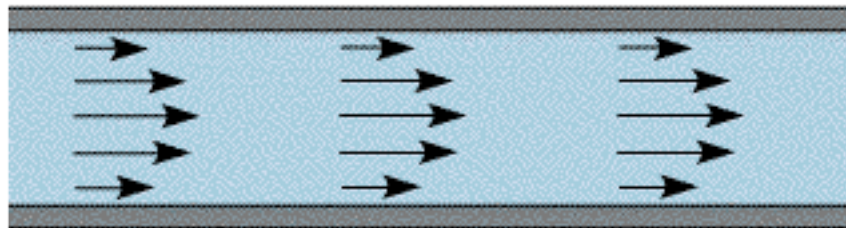
Turbulator



Turbulent



Laminar



Heat Recovery

- ◆ A smart investment that actually pays you back.
 - ◆ Savings for the bottom line
 - ◆ Savings to help offset the cost of new emissions equipment
- ◆ Getting more value out of fuel you are already burning.
- ◆ Don't look past simple solutions as a part of your overall plant improvement process.