

BOILER SYSTEM WASTE HEAT RECOVERY

1. Excessive waste heat source

Industry is the sector that consumes the most energy and poses the greatest threat to the environment. Thermal power, metallurgy, cement, glass, food processing plants, etc. all have incinerators that use coal, oil, gas or electricity to create high temperatures in the production processes. However, these plants only use part of the heat useful for their production. The remaining heat goes into the exhaust gas, wastewater or cooling machine, etc. and is released into the environment, contributing to global warming. This not only increases the cost of finished products, but also causes waste of natural resources and seriously affects the environment.

The unused waste heat will be discharged into the environment through chimneys and exhaust pipes which is wasteful and contributes significantly to the global warming, greenhouse effect, etc., resulting in severe impacts on the environment.

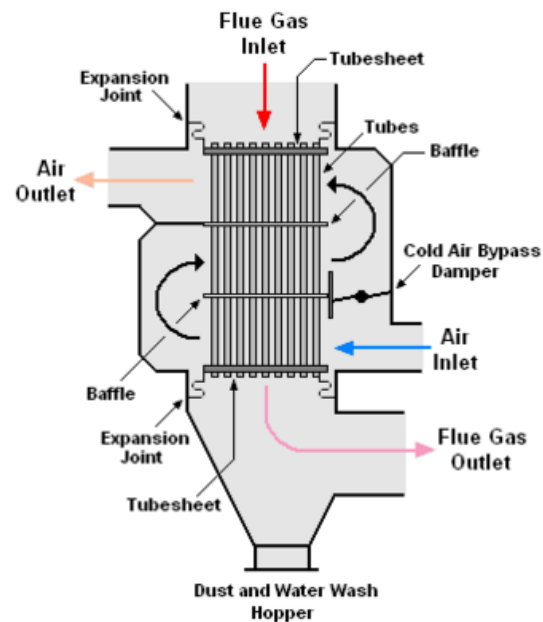
2. Some heat recovery applications in industrial plants

a) Boiler air pre heater

The air preheater is a heat exchanger used in a boiler. The main working principle of the air preheater is the process of transferring heat from the boiler exhaust fume to the air before feeding the air into the boiler combustion chamber.

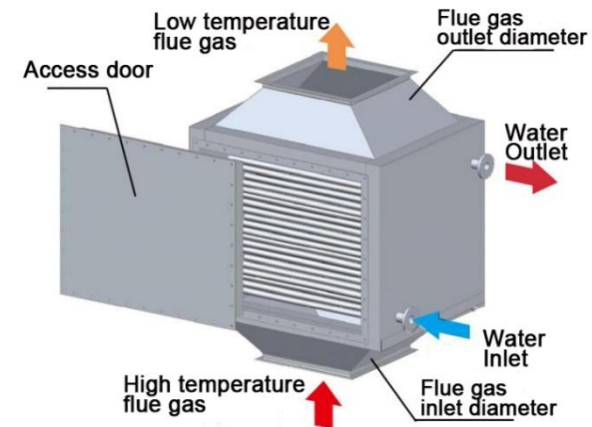
Using an air preheater in a boiler system has the following benefits:

- Good use of waste heat from boiler exhaust fume
- Reducing the number of exhaust fume treatment equipment in the back of the boiler to operate more efficiently.



b) Water economizer

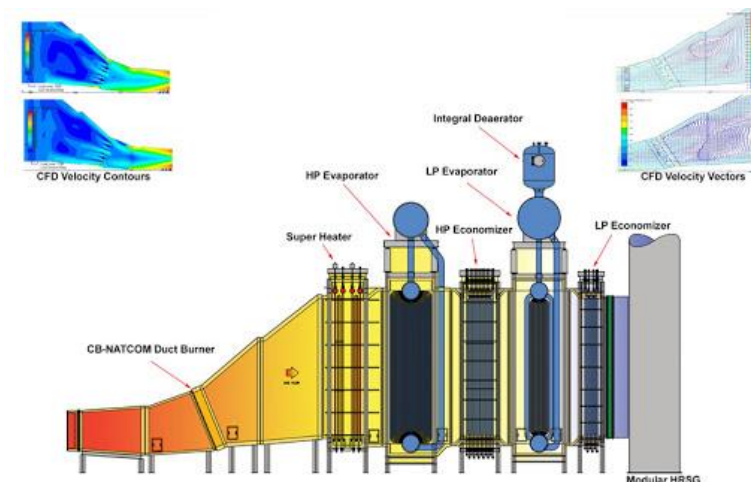
In a boiler, the water economizer is the heat exchanger between the exhaust fume and the boiler feed water. This equipment has the role of utilizing waste heat when operating the boiler, heating feed water for the boiler to save costs and improve the production efficiency.



Principle diagram of the water economizer

c) Heat recovery boiler

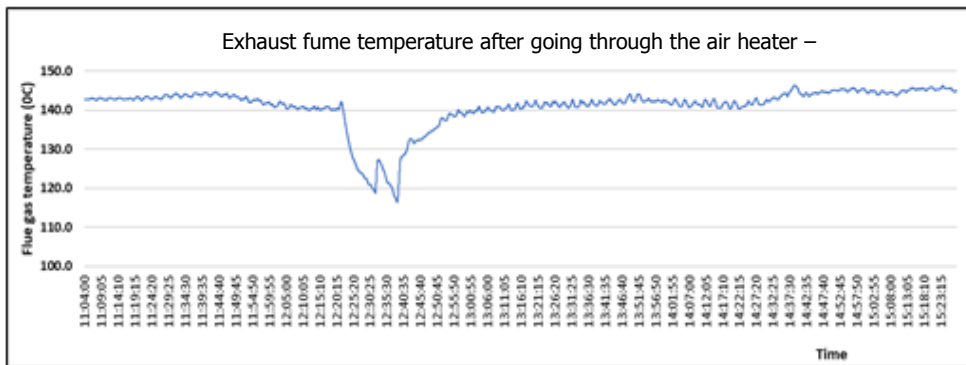
Heat recovery boiler is a device that recovers heat from hot gas streams to produce steam at low pressure for serving the production.



Typical heat recovery boiler diagram

3. Energy saved from recovering boiler waste heat in a food factory

The boiler feed water temperature of the plant before implementing the solution was only 70°C because it was heated from the recovered condensate. The exhaust fume temperature after going through the air heater is still quite high, about 142.6 °C.

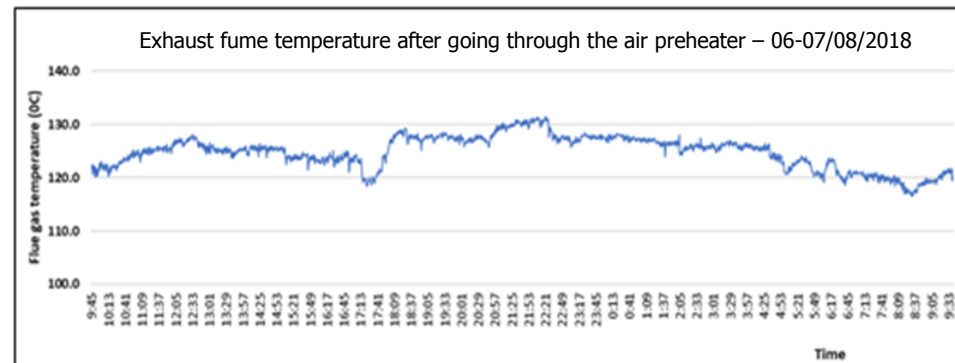


Exhaust fume temperature after going through the air preheater

The factory has installed a boiler feed water heater. Exhaust fume temperature after going through the water economizer and air preheater is about 123 °C.



Water economizer in a factory



Exhaust fume temperature after going through the heat recovery units

Analysis table of energy saving when recovering heat at the factory:

Parameter	Unit	Value
Amount of rice husk consumed in 2017	Tons of rice husks/year	7,100
Boiler feed water temperature before entering the economizer	°C	70
Feed water temperature after leaving the economizer	°C	90
Boiler feed water flow	m ³ /h	6.5
Specific heat capacity of water	kJ/kg.K	4.174
Number of operating hours per day	hour(s)/day	24
Number of operating days per year	day(s)/year	300
Heat saving	MJ/year	3,906,864
Boiler efficiency	%	82.91%
Heat value of rice husks	MJ/kg	17.58
Rice husk saved	Ton(s)/year	268
Average rice husk price	VND million/ton	1.45
Cost saved	VND million/year	388.7
Investment cost	VND million	340
Payback time	Year(s)	0.87

