Application in the tire manufacturing

Pictures: Dan Veitch

Below the dew point

Condensing economizers

Among the emerging technologies developed this decade, condensing economizers offer the opportunity for Hospitals, Process Plants and Large Municipal Buildings not only to reduce fuel use, but also to reduce green-house gas emissions (GHG's), in particular carbon dioxide (CO_2). Large scale savings from utility bills have a clear benefit in providing higher profits and more availability of funds for investment, whilst reductions in CO_2 play a key part in delivering a healthy environment.

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Improving boiler efficiency and reducing CO_2 and GHG emissions

Intended to reduce energy consumption, condensing economisers can also be designed to provide other functions like pre-heating air to Boilers or heating fluid in other process' within the plant or building — An economizer can be simply defined as heat exchanger, available for boilers, or process applications.

When employed onsite in a boiler-house, a condensing economizer can be used to reduce fuel use and pre-heat feed water. It can be connected to multiple Boiler flues to gain maximum benefit from the hot exhaust gasses as well as supply multiple heating applications. In operation, water passes through the economizer on its way to the boiler, thereby, providing a hot water feed, preventing flooding of the boiler with water that is too cold. By preheating the boiler feed-water with energy harnessed from exhaust stack gases, economizers help reduce energy demand and save on fuel costs. In fact, the installation of a condensing economizer can result in between 10 % and 19 % increase in fuel efficiency and

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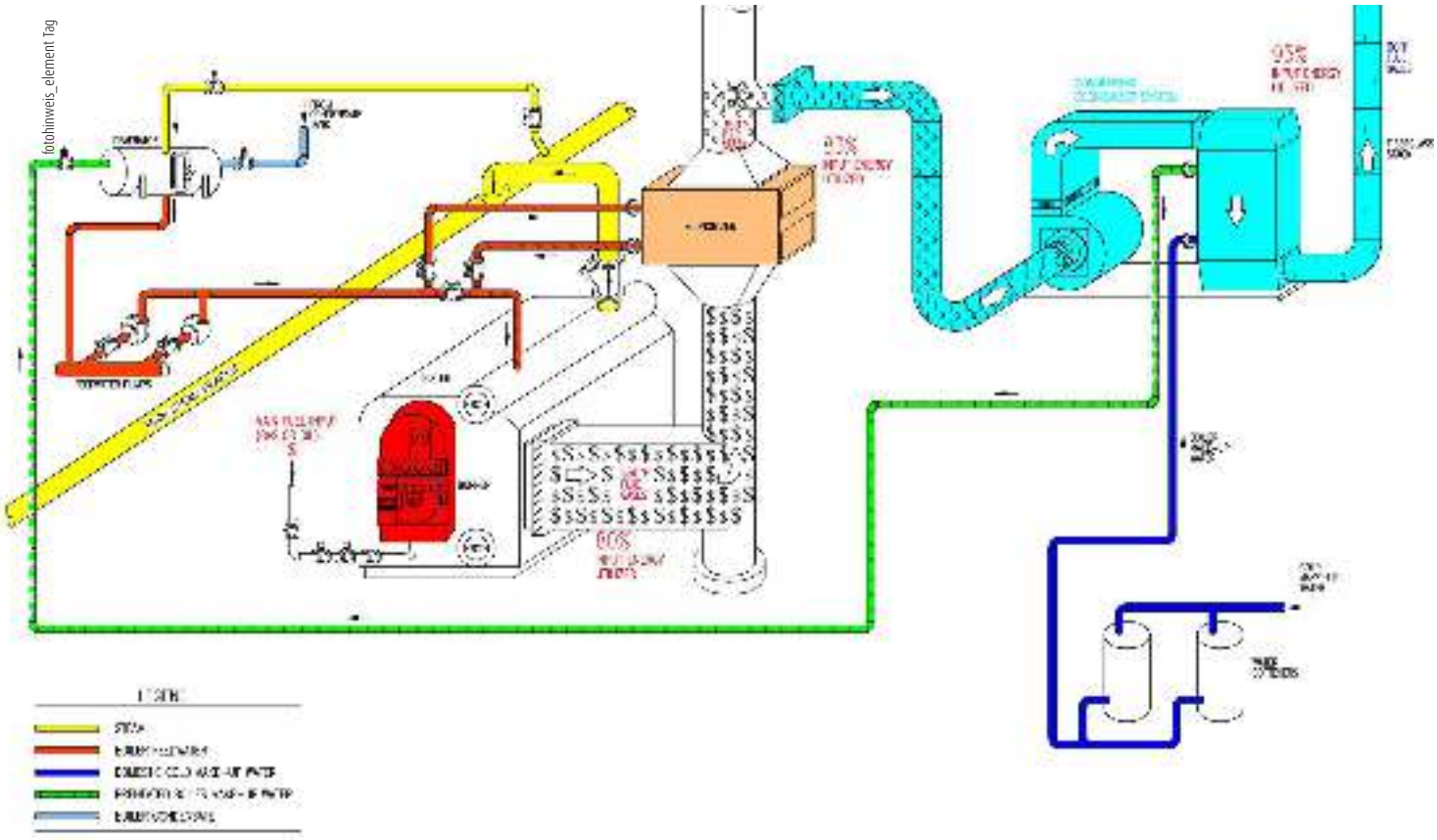

95 % efficient boiler operation

usually is still a viable option if a standard boiler economiser is already fitted. Increasing High natural gas energy prices, cap-and-trade programs and carbon taxation make the economizer an attractive option for any Healthcare, commercial, industrial, or municipal facility that needs to reduce CO_2 emissions and become more energy efficient.

What's the Secret to saving so much energy?

The principle is simple – As much as 19 % of energy in combustion can be lost to exhaust, so capturing as much energy as possible, lost through the exhaust of the boiler, can have a dramatic effect. A large proportion of the energy in the exhaust, however is trapped within the phase change (when water changes to vapour). To capture this large source of energy the heat exchange must bring the exhaust gas temperature below the water vapour dew point, where the exhaust gas condenses (changing the vapour to water again).

An indirect condensing economiser is designed to exchange heat down to a temperature below the dew point and is ideal to harness this latent energy as well as the sensible energy above the dew point, maximising the energy that can be collected. In fact, this technology can harness almost all the available energy in the exhaust stack given the right conditions.

It sounds simple but calculating the dew point for a given application can be complicated so using a specialist in this technology is a must if you are to ensure the most economic payback with an economiser that is built to last.

Waste heat recovery represents one of the largest sources of green energy available for harvest. The Indirect Condensing Economizer is designed to maximize recovery of both sensible and latent heat from exhaust gases. The standard combustion process of most fuels combines hydrogen in the fuel and the oxygen in the combustion air chemically to form water. This water, that is created, is instantly vaporized by the heat of combustion. The vaporization process of the water consumes energy and absorbs approximately 17 % of the total heat energy created by the fuel and it is normally lost to the atmosphere with the boiler exhaust

Application in food production

Application in the chemical industry

gases. The Indirect Condensing Economizer will heat a cold input process water stream that is currently consuming live energy (steam, hot water, electricity, etc.) to heat, and transfer this currently wasted energy from the exhaust gas to back into your process. The condensing economiser transfers enough energy to cool the flue gas below the water vapour dew point, recovering the latent heat and creating a viable water source.

When this water vapour is condensed, the latent heat, recovered at 0.66 kW/kg (Water) (544.88 Kcal/kg), will typically save 0.0566 cubic meters of natural gas.

Given that 12 % by weight of exhaust gas (at 15% excess air) is water, significant energy savings can be achieved through the recovery and use of latent heat. Moreover, every cubic meter of gas saved eliminates 2 kg of carbon dioxide (CO_2) emitted to the atmosphere.

It is often the economic availability of these pre-heating sources (or heat sinks) that defines the amount of energy that can be saved on a site, however paybacks are usually around 2 years or less and will reduce CO_2 and NOx as well as reduce carbon taxes too.

The key is finding the best applications to use the recovered energy whether this is, the raw water make-up, feed to the deaerator in the boiler-house, or any other process in the Hospital, plant, factory or building. A good place to start is the Boiler Make up water and any Hot Water System that consumes a lot of cold water.

All of the latent and sensible energy is transferred to the heated fluid in the heat exchanger in a single pass providing the correct outlet temperature to preheat the associated process. To maximise energy saving, multiple coils can be fitted in multiple combinations enabling the maximum savings in any given Hospital, plant or building.

Simple, straightforward installation

Built as part of a single heat exchanger, the in-direct condensing economiser uses the smallest footprint possible and is simpler to install than other systems.

With all the thermal energy saving (both latent and sensible) happening in the heat exchanger there's fewer parts to install and with the economi-

Procter & Gamble Inc., Mehoopany, Pennsylvania

- Single Stage ConDex System
  – Boiler Make-up Water
  – 700 GPM from 65F to 170F
- Reduces DA steam requirements: 30,000 lb/hr
- Heat Recovered 36,700,000 BTU/hr
- Annual Savings: over $ 1 Million

Graphic Pckaging, Kalamazoo, Minnesota

- ConDex System uses 155,000 Lb/hr of boiler flue gas at 325 F cooled to 131 F
- Using two coils, process and makeup water are heated with 8.47 MMBTU/Hr of waste energy
- System recovers nearly 65 gallons per hour of reusable water
- 5,238 Tons of CO_2 and 6,640 Lbs of NOx are offset per year

ser not needing to be in the original exhaust stack connections are kept simple too. The deign also lends itself to occupying the smallest of footprints and can be mounted on the ground, inside or outside, or anywhere there is a supporting structure. The only things you'll need to connect are the inlet and outlet pipe/s and the exhaust ducting from the boiler flues to the heat exchanger.

Recovering waste heat

All that energy being lost through your boilers exhausts can be recovered offsetting the use of fossil fuels and reducing GHG's, lowering your carbon footprint and improving site wide efficiencies.

By using the waste heat in the exhaust the original fuel is reduced, increasing the thermal capacity of the boiler-house overall and with the reduction in emissions the whole package helps you to better achieve your regulatory emissions requirements.

Technology adoption

Condensing Economisers are now being more widely adopted across many different industries as focus on large energy reduction intensifies and the indirect condensing economiser is establishing itself as the most beneficial.

After installing an indirect condensing economiser in a Hospital where make up water was heated by the economiser from 7 ° C to 88 ° C and a second coil on the economiser was used to heat the domestic hot water from 7 ° C to 60 ° C the reduction in energy consumption amounted to 1,512 kW per hour with peak savings of over 2051 kW per hour. CO_2 was reduced by 3,209 tons and NOx by 2.11 tons saving the Hospital £386,018 with a payback of less than 8 months.

Once the economiser was installed at a University to pre-heat their district heating loop, average fuel cost savings of £430,395 per year are being achieved reducing CO_2 by 3,432 tons and NOx by 2.25 tons. The district heating loop was heated from 16 ° C to 91 ° C saving 1,758 kW of energy per hour. The installation paid for itself in less than 1 year.

And at Toyota automotive assembly plant where the waste heat was recovered from 3 boilers and this heat was used to heat incoming boiler feed water from 42 ° C to 81 ° C recovering on average 804 kW per hour with peak savings of 1,143 kW per hour. This also saved 1127 tons of CO_2 and 0.74 tons of NOx. Overall the economiser is saving £164,925 per year giving a payback of less than 1.5 years fully installed.

Those that have adopted the technology have benefitted from large reductions in fuel use, lower emissions and savings in associated taxations or trading. Those that have not considered this innovative technology yet, risk losing the competitive edge and a means to greatly reduce their impact on the environment around them.

Examples from the paper industry

For the successful use in the paper industry are the most important onesKey data in the info boxes (left) put together.

www.wis-industries.de