Waste as a resource

Recovering waste heat can be more than the effective use of resources; it also provides a mechanism for pollution control. Here, David Missions describes the process.

We may all applaud the control of pollution or the efficient use of resources, but in the harsh commercial world the cost of installing pollution control equipment will be reflected in a company's profitability and competitiveness. No-one wants to lose out to environment-unfriendly competitors.

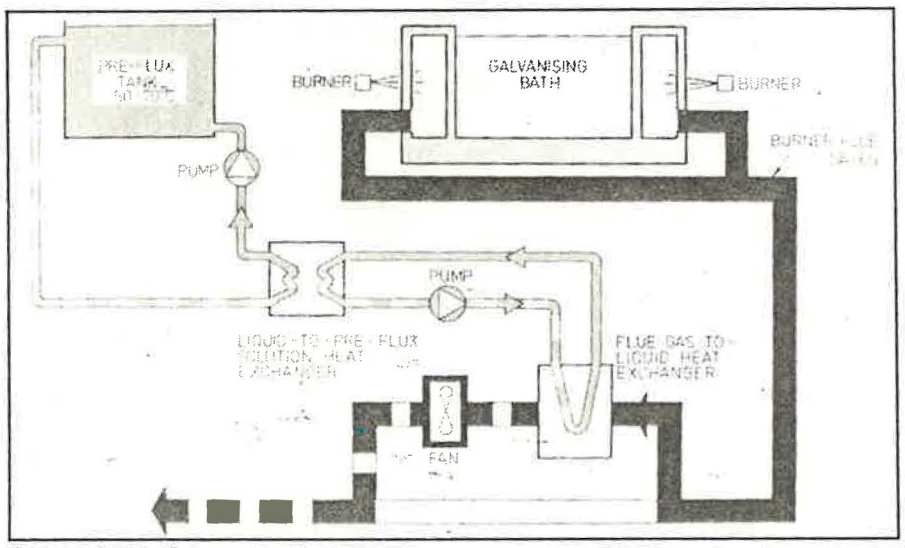
However, there does exist a way for companies to reduce pollution while actually saving themselves money – heat recovery.

Heat recovery is an established technique which has found wide application right across industry. Properly designed and installed systems offer a very attractive return on investment. In recent years, though, concern with environmental issues has highlighted another benefit to heat recovery: slowing down the greenhouse effect.

Heat recovery systems can also reduce pollution directly by the removal of pollutants from exhaust gases.

In order to prevent fouling of the heat exchanger it is often necessary to use filtration techniques to remove or at least reduce the amount of particulates in the exhaust stream. In addition the cooling of waste gas may lead to pollutant gases condensing out.

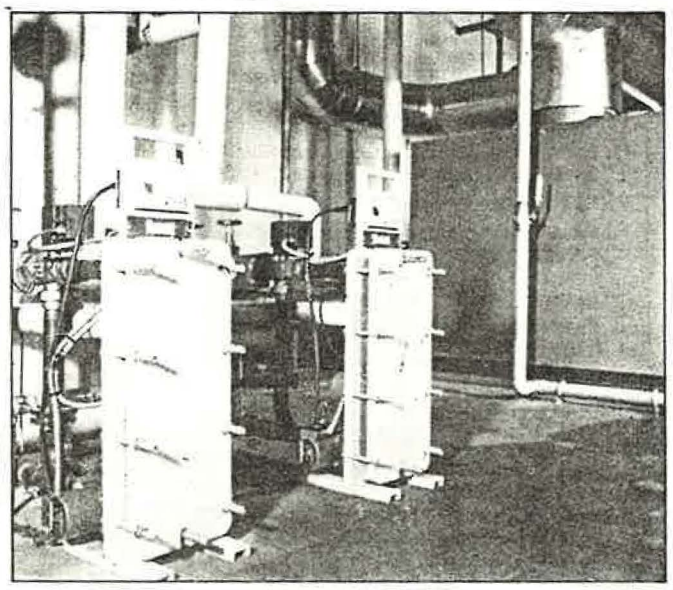
The most obvious example of this is in oil and coal fired plants, where SO_2 emissions can be cut significantly by cooling the flue gas below the dew point of the acid gas. This enables much more heat to be recovered – often up to three times that from a conventional system. Obviously the corrosive acid condensate needs to be neutralised and handled in a proper manner.



A schematic of the Osprey galvanising bath heat recovery system at Newport Galvanisers. Heat recovered from the galvanising bath burner flue gases is used to heat the pre-flux bath.

In applications where the pollutant is water soluble it is possible to combine heat recovery with pollution control by use of a spray recuperator. This is basically a gas scrubbing device in which water or some other liquid is sprayed into the waste gas stream. Heat is transferred directly from the gas to the water, then recovered in a secondary heat exchanger. This type of plant is also effective for removing particulates.

The effectiveness of spray recuperator systems is illustrated by an installation



Heat exchangers for DHW

One method of eliminating bacteria from domestic hot water systems is to install instantaneous water to water heat exchangers which do not incorporate static hot water areas – a prime breeding area for *legionella*. These take cold supplies from the mains and heat the water directly prior to demand.

The Stokvis plate heat exchanger meets this requirement. It comprises a series of vertically mounted, corrugated plates in a sandwich structure. The unit works on a primary and secondary contra-flow system, the corrugations creating turbulence between the plates to ensure a high degree of heat transfer.

Maintenance is simple; the corrugated sheets are clamped together with the water connection at one end. When cleaning is necessary, the plates are unclamped giving direct access to both sides of each plate. To increase the capacity of the heat plate exchanger, additional plates are simply bolted into position.

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carried out by Osprey Corporation for a major brewer. The company was asked to design and install a system to recover heat from the kettle, or copper, in which the fermented malt mixture or wort is boiled.

The exhaust stream contains large quantities of contaminants such as dust and other pollutants which can cause foaming. In addition, since the temperature in the kettle must be maintained at a constant level to avoid heat spoiling, the pressure drop in the heat recovery system must be kept to the absolute minimum.

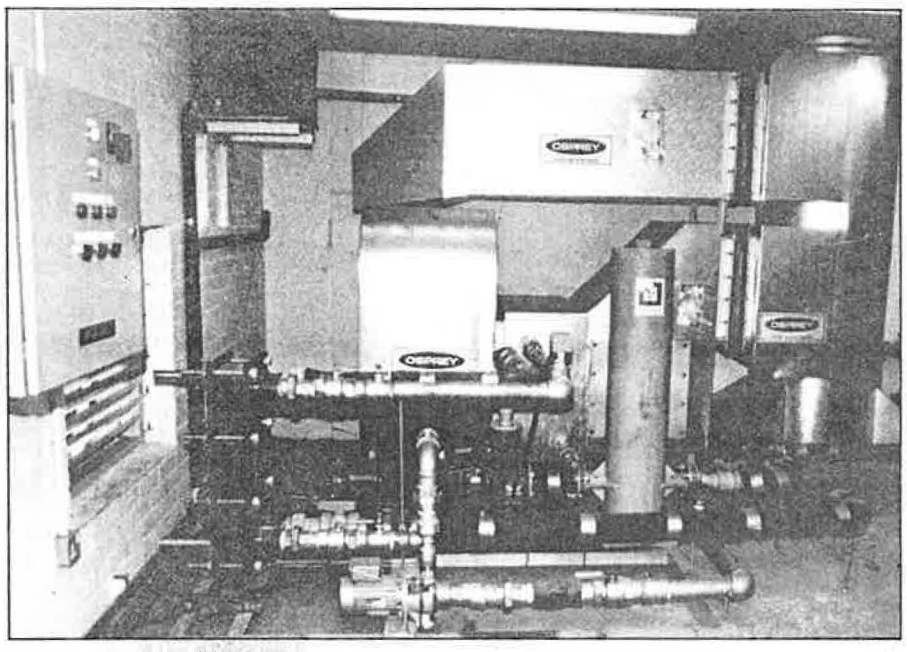
Installing a spray recuperator enabled virtually all of the steam to be condensed, producing hot water at 90-95°C which is then fed back into the process – cutting the energy consumption by 7MW. Because the spray recuperator is essentially an open box the pressure drop is almost negligible.

Another approach to heat recovery is used in the galvanising industry. Here the major problems any system has to cope with are extreme temperatures and a highly corrosive environment.

In Osprey's system, heat is recovered from the galvanising bath burner flue gases and used to heat the pre-flux bath. A gas/liquid heat exchanger recovers heat from the flue gases (at 450-500°C) into a closed loop water circuit. A liquid/liquid plate heat exchanger is used to heat the highly corrosive zinc ammonium chloride pre-flux solution. Payback periods of between 18 months and two years have been achieved using this system.

Pollution control and energy efficiency can go hand in hand. Heat recovery offers great potential for reducing consumption of fossil fuels, thus reducing the emission of greenhouse gases such as CO_2. In addition, in most cases it is possible to design heat recovery plant in such a way as to remove pollutants directly.

David Missions is with the Osprey Corporation.



The galvanising bath heat recovery system, illustrated schematically on the previous page, is shown here in the flesh.

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