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SOLEX THERMAL SCIENCE

New face to waste heat recovery

Jamie Zachary, marketing and communications manager

PHOTO: SOLEX/ECONOTHERM

Econotherm's heat pipe heat exchangers can supply combustion air pre-heaters with recovered heat that is otherwise lost.

A recent acquisition by Solex Thermal Science is expected to help the thermal energy and bulk materials specialist company grow its waste heat recovery business within the fertilizer industry.

Canadian-headquartered Solex announced the purchase of Econotherm, a leader in waste heat recovery technology, in June this year. Econotherm manufactures heat pipe heat exchangers that capture difficult-to-recover heat from industrial sources including hot and/or dirty exhausts. The UK-based company was established in 2007 and currently operates in the automotive, metals, construction, food, mining, oil and gas, power generation and pharmaceutical industries.

Better together

The Econotherm acquisition was a natural progression for Solex, according to CEO Lowy Gunnewiek, as both companies share a passion for working with customers to best address their operational needs.

"Our global client base in industries such as fertilizer has been asking for an even deeper suite of best-in-class, sustainable solutions that align with their operating needs and respective environmental, social and governance strategies," says Gunnewiek. "By combining Econotherm's deep expertise in waste heat recovery with our established heat exchanger solutions, we now have much deeper capabilities to help customers produce a better product at less expense to them and the environment."

Solex is a global market leader and developer of high-efficiency, indirect heat exchange technology for the heating, cooling and drying of free-flowing granular materials such as solid granules, pellets, beans, seeds and particles.

Over the past 30 years, the company has installed some 900 moving bed heat exchangers (MBHEs) in more than 50 countries worldwide. Originally serving the Canadian fertilizer industry, Solex has since expanded into other industries such as oilseeds, sugar and industrial materials such as minerals/sands, chemicals and polymers.

Delivering the energy transition

Solex's acquisition of Econotherm comes at a time when the company's heat exchangers are being widely installed within the energy transition sector – with a particular focus on industrial waste heat recovery.

Igor Makarenko, Solex's Global Director, Fertilizer, believes there is great potential to build on the existing success of the company's plate-based technology by 'upcycling' more energy from hot working fluids during cooling processes.

"In most cases, the hot fluid that comes out of our moving bed heat exchangers, when cooling fertilizer, is sent to a cooling tower where all the energy within it is rejected to the ambient air," observes Makarenko. "However, this energy can be used in other locations of the plant as useful thermal energy."

The recovered heat can be used, for example, to pre-heat air for combustion systems upstream in the production process – generating the heat needed by equipment such as fluid beds or rotary drum dryers. Alternatively, the recovered heat can be used to pre-heat air to 'trim dry' the fertilizer in MBHEs.

"We are also looking at combining our MBHEs with industrial heat pumps to upcycle the energy from waste to a heat source," says Makarenko. "Heat pumps, being electrically driven, do not create any additional CO_2 emissions either."

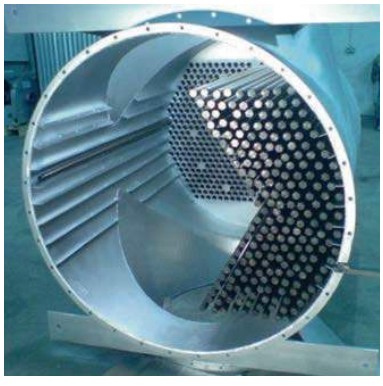

PHOTO: SOLEX/ECONOTHERM

Econotherm's heat pipe heat exchanger equipment incorporates patented superconductor technology –and is highly efficient at recovering waste heat from process exhaust gases.

Complementary technologies

Econotherm's heat pipe heat exchangers (see photo) will complement Solex's existing technology during drying and other process stages, according to Mark Boocock, the company's Managing Director, as well as providing new opportunities for heat recovery and re-use in other areas of the fertilizer production process.

Econotherm's patented superconductor heat pipe heat exchangers can extract heat from 'one-pass air' and then use this to pre-heat ambient air that goes back into the dryer. In Boocock's view, Econotherm's technology has clear and obvious potential for recovering energy from the particle-laden air generated as exhaust during fertilizer drying processes.

"With heat pipe heat exchangers, fertilizer producers can reduce the natural gas consumption needed for drying fertilizer, while also reducing the temperature of the air that's being sent to the scrubbers" says Boocock. "To reduce scrubbing cacpacity, our heat exchangers will also remove some of the particulate load in the air stream."

Upstream fertilizer applications

Ammonia and nitrate production – manufacturing steps further upstream in nitrogen fertilizer plants – are other process areas where heat pipe heat exchangers can be productively used to capture otherwise wasted heat, predicts Boocock.

Ammonia production, for example, employs large gas-fired heaters that supply heat to steam reformers. Solex and Econotherm will therefore be jointly exploring opportunities to recover heat from the exhaust gas coming out of these gas-fired heaters. This has the potential to reduce the amount of primary energy needed in steam production by reintroducing recovered heat back into the heater.

The installation of Econotherm's technology in fired heaters in the oil and gas industry is, says Boocock, already saving its customers "millions of dollars each month" in reduced fuel costs and is cutting greenhouse gas emissions. The use of heat pipe heat exchangers in this sector is long established and has been highly successful.

"It's making a profound difference," says Boocock. "Our solutions, many of which are first-of-its-kind installations, have achieved successful energy savings in applications otherwise considered unsuitable for conventional heat exchanger equipment."

The turbines and condensers in nitric acid production, meanwhile, act as large heat sinks, notes Boocock. In his view, the significant exhaust streams coming out of these front-end turbines provide ideal opportunities for waste heat recovery.

Eliminating catastrophic failures

Additionally, the shell-and-tube heat exchangers normally used to remove heat from tail gas/nitrous gas downstream of boilers can be difficult to manage, suggests Boocock. Typical problems include thermal stress cracking caused by differential expansion between surfaces and casings, and the condensation induced by cold spots leading to corrosion. The traditional thin metal surfaces of shell-and-tube heat exchangers are also vulnerable to erosion and corrosion.

Econotherm's technology, in comparison, is much less prone to these operational issues. In heat pipe heat exchangers, pipes can expand and contract freely without applying stress to casings, for example, while their isothermal operation eliminates cold spots and condensation. Because heat transfer is not affected by wall thickness, thicker walls are also used with this technology – typically 2.5-3.5 millimetres – providing higher erosion allowances.

Heat pipe heat exchangers also eliminate the catastrophic failures associated with other types of heat exchanger. This is because of built-in multiple redundancy, an intrinsic feature of the technology. Each heat pipe within Econotherm's equipment functions independently and autonomously.

"As a result, in general, the consequence of failure is minimised and manageable," says Boocock, whose company is at the forefront of heat pipe research and development.

"There is a lot of waste heat coming out of a fertilizer plant that's not being recovered. What we are offering is a type of heat exchanger that moves the risk and return on investment indicators in a positive direction – allowing fertilizer producers to look closer at their existing processes," sums up Boocock.