Case History

Exchanging Waste For Money

Tranter plate & frame heat exchangers (PHEs) recycle heat energy to district heating loop, helping increase thermal efficiency by 20%.

Locked within urban waste streams lies a lifeblood of civilization...energy. It takes ingenuity to unlock and capture this potential without environmental damage or thermal inefficiency. SYSAV[1], an integrated waste management and energy company in Malmö, Sweden, is using Tranter plate & frame heat exchangers to capture waste heat from boiler flue gas condensate and cool this stream prior to purification and discharge. This flue gas condensation heat recovery process is providing SYSAV with attractive financial and environmental benefits. For a low upfront project cost, the company is obtaining a significant energy yield, with no increase in emissions.

[1]SYSAV is an acronym for Sydskånes avfallsaktiebolag, a company owned by 14 districts in Skåne with 630 000 inhabitants and approximately 6000 corporate customers.

Energy for district heating and power generation

SYSAV collects, recycles and treats commercial, industrial and household waste and garbage. The mission of SYSAV is to provide environment-friendly waste disposal and recycling and efficient waste-to-energy conversion. Recent tightening of EU emissions standards caused SYSAV to embark upon a major upgrade and expansion totaling 200 million SEK (U.S. $26 million). The scope included installation of a modern, four-stage wet flue gas scrubbing and heat recovery process by Götaverken Miljö AB serving two of the boiler lines. SYSAV also carried out upgrades to two of the waste-fired boilers.

The waste-to-energy plant operates three waste-fired boilers; all three supply heat energy to the Malmö and Burlöv district heating net. The newest boiler supplies steam for approximately 145,000 MWh/yr of electric power generation. Energy from the plant supplies

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The heat transfer people

Juhani Sirviö of SYSAV (left) with Sven Brantebäck of Götaverken Miljö AB and the Tranter PHE Model GXD-205 that transfers heat energy from top stage scrubber condensate to district heating water.

about 40% of the district heating load, equivalent to the energy in 100,000 tons of heating oil, or enough to supply the annual needs of 80,000 three-room apartments (almost 1,000,000 MWh). An ongoing expansion will raise output to 50% of the district heating consumption.

The gas cleaning process takes place in a four-stage scrubber, which controls the discharge of ammonia, hydrochloric acid, sulfur dioxide, dioxin and heavy metals. The SYSAV system incorporates the proprietary ADIOX® dioxin reduction technology[2] from Götaverken Miljö AB.

[2]ADIOX® technology separates dioxins from gases through absorption/adsorption in a polymer material. The material consists of polypropylene doped with carbon particles. The process has been developed in cooperation with Forschungszentrum Karlsruhe. Götaverken Miljö has the global rights to market and sell ADIOX®.

Hot condensate to district heating

SYSAV has been able to capture significant heat energy from the scrubbing process. When the flue gases are washed with water that is cooler than the flue gas' dew point, condensation occurs in the top stage of the scrubber. Heat in the condensate is transferred to the district heating loop through a Tranter PHE Model GXD-205 plate & frame heat exchanger. An in-line strainer at the flue gas condensate (hot) side inlet on the GXD-205 collects particulates carried along with the condensate. This tower packing material increases the contact surface between the gas and process liquid, improving the rate of acid and dioxin separation. During the exchange, the scrubber condensate is cooled to a temperature 1–2 °C (1.8–3.6°F) above the incoming district heating water.

Two other heat exchangers complete the condensate heat recovery and cooling process. A Tranter PHE Model GCD-016 heat exchanger uses district heating water as cooling media for the Stage 4 flue gas condensate. A GLD-013 unit uses ground water to further cool the Stage 4 water and also to cool process water from scrubber Stage 3, the sulfur dioxide step. The plates for all three units were manufactured in 254 SMOTM stainless steel (1.4547) to withstand chlorides and fluorides in the flue gas condensate.

Tranter PHE Model GCD-016 The heat exchanger transfers heat energy from Stage 4 fl ue gas condensate to district heating water.

Cooled process water goes to the water purification system and then to discharge. When the district heating plant is not operating, ground water alone is used in the GLD-013 to cool the Stage 3 condensate before it is pumped to the purification system.

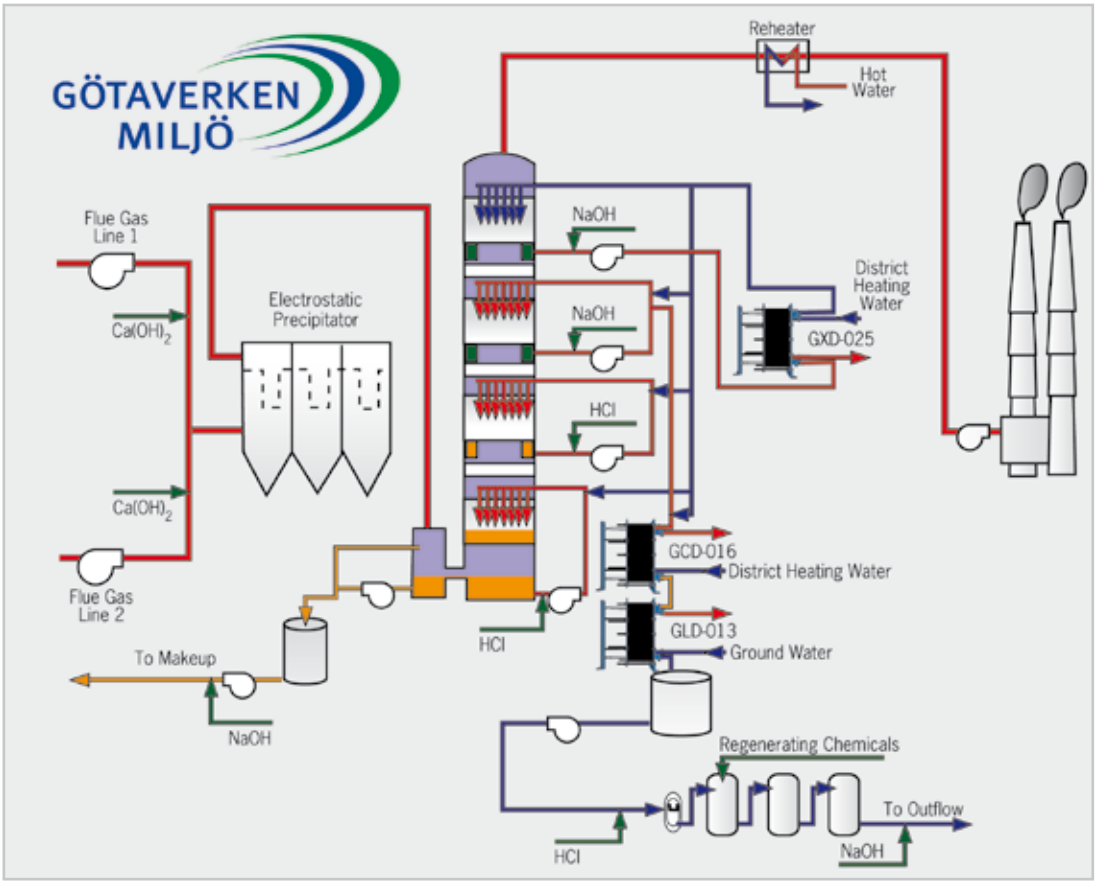
Performance makes the difference

Götaverken Miljö project engineers selected Tranter PHE plate & frame heat exchangers over shell & tube heat exchangers for their cost-effective performance within the constraint of high materials costs. Other factors were the units' compact size that minimized footprint and Tranter's technical solution and support.

Broad potential for savings

The flue gas condensate heat recovery strategy as employed by Götaverken Miljö at SYSAV has potential for any boiler flue gas stream 150°C (300°F) or above. By cooling the flue gas to below its dew point, it is possible to capture large quantities of energy during gas condensation. The efficiency can be further improved by inclusion of a heat pump. By recycling otherwise wasted heat energy, plants operating boilers with scrubbers can improve their overall thermal efficiency, with significant fuel savings.

Tranter PHE GCD-016 and GLD-013 units recycle heat from upper scrubber stages and cool process water for temperature-controlled outflow.



The SYSAV Flue Gas Condensate Heat Recovery Process

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