Reduce Fuel Bills by 10% to 20% with FLU-ACE® Waste Heat Recovery from Tissue Machine Exhausts

Most paper mills have the opportunity to economically reduce energy bills by 10% to 20%, even after a great deal of heat recovery has already been done at the site.

Typical paper mills use most of their energy in the drying process. In fact some 60% to 80% of a paper mill's energy can be used for drying of the product. In this drying process energy is not actually "used", but rather it is converted to latent heat in the evaporation process. As such this energy used for drying is still available to be used again, in the form of latent heat in the dryer section / hood exhausts. The issue is that this energy is of a lower grade (temperature) than that which can be used for drying. With high temperature dryer / hood exhausts often some air-to-air heat recovery can be done to preheat dryer air, and / or steam can be generated and returned to the process with heat recovery steam generators (HRSGs), but even after these heat recovery stages, which recover only a small fraction of the waste heat (the high-temperature sensible portion), some 80% of the waste heat is still available in the form of lower temperature latent heat (water vapour). This energy cannot all be used locally at the site, as there is not enough demand for all the escaping low grade heat, but with proper technology, analysis, and design, a significant quantity of this low grade heat can be recovered and reused in the mill's various heating systems to reduce site energy bills by 10% to 20%.

FLU-ACE® technology is one of these options. The FLU-ACE® can recover as much as 90% of the heat normally lost through dryer section / hood exhausts in the form of water at 50°C to 70°C, depending upon the exhaust stream humidity. This is possible using the FLU-ACE®'s unique direct contact (gas/liquid) packed-tower design, enabling optimal recovery of both sensible and latent heat, in widely varying operating conditions.

The Kruger Products Gatineau Mill in Québec, Canada, with a capacity of 80,000 metric tonnes per year, is comprised of a distribution center, a converting facility and a mill. It operates three tissue machines and state-of-the-art converting equipment. The exhaust from the three tissue machines are a source of recoverable and useful heat. Two of the three machines had previously been equipped with exhaust stack economizers which were used to preheat shower water. In spite of the heat recovery technology that was already in place, a large amount of waste energy still existed in the exhaust air streams and was being discharged and lost to the atmosphere.

A FLU-ACE® condensing heat recovery system with a heat recovery capacity of 31.5 GJ/hr was installed at the facility. FLU-ACE® recovers waste energy from the combined exhausts of Kruger's Machines #3 and #4. Waste heat recovered from the exhaust is used to displace steam demand by heating process water streams, and plant makeup air systems.

Specifically, the heat is delivered to:

• Machine #3 shower water;

• Reclaim pulper make-up (white) water;

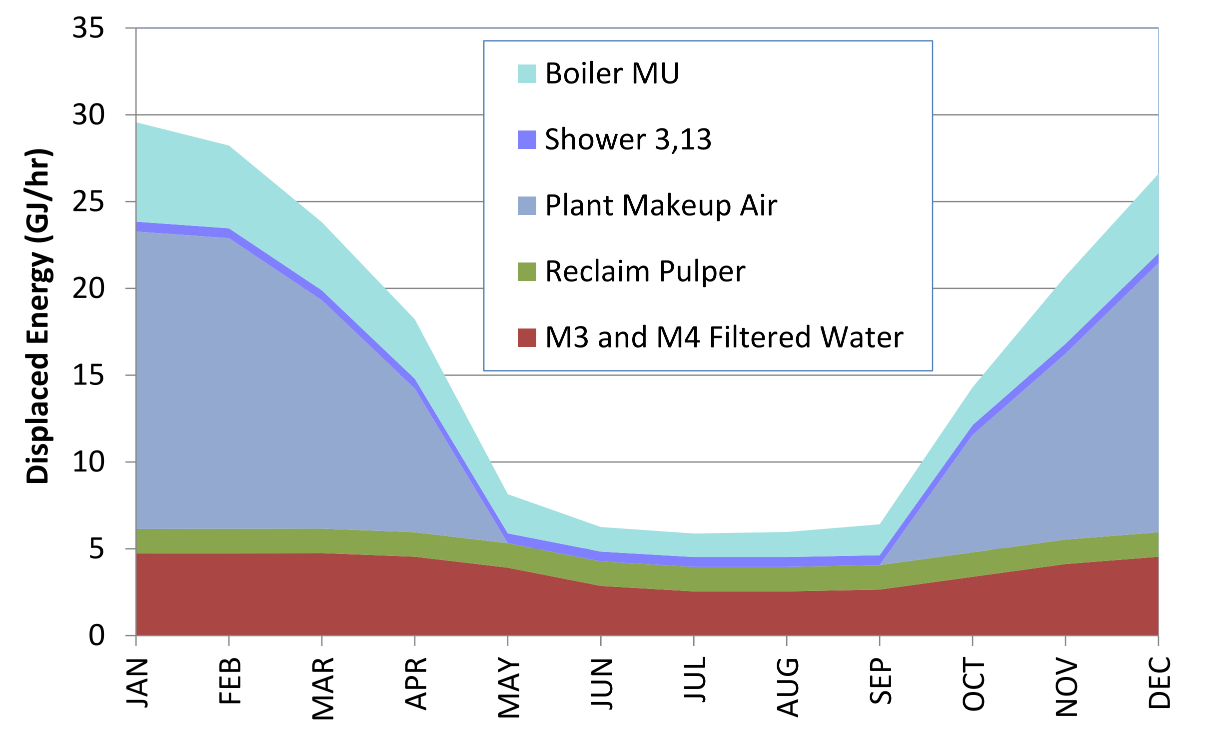
• Chemistry (kitchen) water;

• Boiler plant make-up water; and

• Plant make-up air.

As some of these heat users are seasonal (plant make-up air heating), the heat delivery profile is not flat, but seasonal. The savings realized follow the profile shown in Figure 1.

Figure 1 - Energy Savings by Month



A three dimensional cut away of a typical FLU-ACE® condensing heat recovery tower is shown in Figure 2 below.

Figure 2 – Cut Away of FLU-ACE® Tower

Figure 3 below illustrates how the FLU-ACE® heat recovery system works:

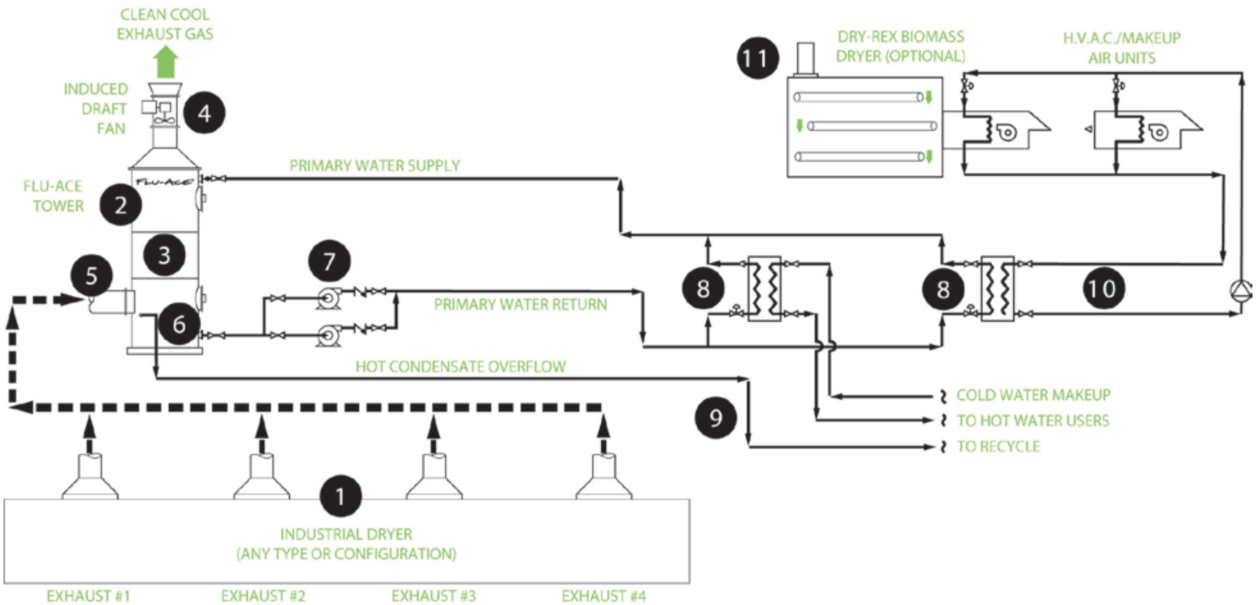


Figure 3 – Typical FLU-ACE® Process Schematic

1. Conventional heat recovery technologies require a dedicated piece of equipment for each boiler exhaust – not with FLU-ACE®.
2. The varying flow of flue gases emitted from multiple dryers or dryer exhausts can be efficiently processed by a single FLU-ACE®. This means a lower initial investment, lower operating costs and a higher return on investment with FLU-ACE®. FLU-ACE® will have an ongoing positive effect on your bottom line throughout its long operating life (20+years in most applications).
3. The FLU-ACE® unit's unique internal structure ensures maximum condensing heat and mass transfer. It also enables an unobstructed flow of liquids and gases through the tower, providing continuous operation with minimal downtime.
4. FLU-ACE® is equipped with a variable speed, induced draft fan at the tower inlet or outlet. The fan automatically maintains the optimum flue gas static pressure set point at the tower inlet preventing interference with upstream processes.
5. Hot water is produced when boiler flue gases are cooled and water vapor is condensed in the FLU-ACE®.
6. The hot water (at up to 70°C) accumulates in the receiver where it is treated (if required) to neutralize acids and remove suspended solids.
7. FLU-ACE® uses variable speed pumps to maintain the temperature of the hot primary water leaving the receiver at the desired level.
8. Control valves regulate distribution of the primary water to the heat exchangers.
9. Heat can be transferred to secondary water for direct process water heating or boiler make-up heating
10. Heat can be transferred to secondary glycol fluid (if required) or the FLU-ACE® water can be used directly in coils for plant makeup air heating, or boiler / dryer combustion air preheating.
11. FLU-ACE® can also be used to provide heat to Thermal Energy's low temperature DRY-REX™ biomass dryer for turning biomass feed stock into high-efficiency biofuel, or for drying waste sludges from water treatment.

Note that FLU-ACE® can also be reliably used to recover waste heat from boiler exhaust at paper mills as an alternative heat source to the dryer – the most economical configuration must be determined for each site.

A thorough validation of the Kruger FLU-ACE® system's performance was completed. Since October 2010 when the system became operational, the facility has been realizing cost savings of £1.1 million each year, and has been reducing its yearly CO_2 emissions by 8,853 tonnes – the equivalent to permanently removing 1,950 cars from the road. This amounts to an annual fuel use reduction of over 15%.