

## ADVANCED WASTE HEAT & WATER RECOVERY SYSTEM DEMONSTRATION AT L.&N. COSTUME AND LINEN SERVICE

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### TECHNOLOGY DESCRIPTION

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The Transport Membrane Condenser (TMC) based waste heat and water recovery system was first developed to recover pure water and low-grade waste heat from flue gases generated from natural gas combustion processes, sponsored by US Department of Energy and other industrial sponsors. While low temperature and high-moisture content effluent is prevalent in many industrial process exhaust streams, recovery of the heat and moisture is not typically practiced simply because of the economics: low heat transfer efficiency and equipment corrosion issues cost more than the heat and water vapor are worth. The TMC offers a cost-effective solution to this issue.

The TMC can recover moisture from many waste heat streams and with it, both sensible and most of the latent heat therein. For example, a 300°F natural gas fired boiler flue gas contains about 18% in volume moisture and the latent heat in the vapor accounts for 70% of the total heat in the effluent. The TMC reclaims the moisture by drawing it through a nanoporous membrane via capillary condensation and separation. In this working mode, the membrane only allows pure water to pass through, providing high quality and mineral-free water to the facility. TMC-based water reclamation also relieves a facility of condensate disposal issues.

The TMC unit is a modular design so it can be scaled up easily. A TMC module is made of several hundreds of nano-porous ceramic membrane tubes. Cold feed water flows through the tubes, and the moisture laden waste gas stream flows across the tubes. The waste heat and pure water are recovered into the cold water stream while other gas components in the exhaust gas stream are blocked from passing through the membrane because of the condensate inside the membrane pores. TMC can operate in a mildly corrosive environment whereas conventional heat recovery equipment simply cannot.

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A TMC unit was installed on top of the steam tunnel exhaust stack as shown in the picture. Exhaust from the steam tunnel with a flow rate of 2,300 cfm at 130°F saturated with water vapor, flows through the TMC, and exits at 105°F. An 840 gph water stream at 75°F enters into the TMC, exits at 120°F. By installing the TMC, about 320,000 Btu/hr waste heat was recovered and enters into the water stream to preheat it from 75°F to 120°F for the following plant process use, and at the same time recovers about 50gph pure water from the steam tunnel exhaust. The energy recovered in 3 hours is enough to heat 15 loads of water for the plant largest-capacity washing machine to reduce the plant boiler steam demand, and the recovered water in 3 hours is enough to fill 1-1/2 loads of the washing machine. Hot water available in the hot water storage tank in the morning, provides the potential for a quicker daily startups and faster production times.



*TMC installed on top of the steam tunnel at L.&N.*

### GTI PROJECT CONTACT

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