

Energent Tests 4 MW Two-Phase Turbine

In April 2014 Energent performed a test of a 4MW turbine for clients in China. The test was completed at the Santa Ana Test Facility in accordance with the API-617 requirements. The turbine will be used at an oil import terminal and refinery in China where Paraxylene (PX) is produced. The turbine runs inside of a Kalina waste heat recovery system. The Kalina system is an environmentally-friendly turbine since the power generated by the turbine is already available and free in the form of waste heat at the refinery. The working fluid is a mixture of ammonia and water vapor. The turbine is unique in that it is a two-phase turbine and will at times be running with very wet vapor in the ammonia/water mixture. Due to high vibrations, conventional axial flow and radial inflow turbines are not capable of running in such very wet gas flows, and eventually form damage on wetted surfaces impacted by the wet vapor droplets. The Energent turbine overcomes these wet vapor problems and has shown good reliability in previous wet vapor flow situations. The Energent turbine was manufactured by Energent in accordance with the specifications of API, ASME, IEC, and the Chinese Guobiao GB codes.



Figure 2: The turbine in operation during the 4 hour customer witnessed endurance test at night. The plume of gas with vapor can be seen exiting the turbine while the turbine operated at 13 650 rpm.



Figure 1: Test arrangement of a 4MW turbine only at the Santa Ana facility of Energent.

The flow process conditions at the final refinery site could not be simulated during testing. Therefore, only a turbine mechanical spin test was performed in Santa Ana using compressed air to drive the turbine. The value of the mechanical spin test was to verify all the controls as well as the temperatures and vibrations were in the acceptable ranges, as measured by the instruments. The turbine speed was 13,000 rpm and an over speed trip test was performed at 13,650 rpm. Figure 1 shows the turbine arrangement. Figure 2 shows the turbine during the test with vapor leaving the turbine outlet.

Free waste heat at refineries is commonly available. Customer representatives have stated that they have many other locations available at refineries where waste heat recovery projects are being evaluated. Sizes up to 10 MW are being considered for future applications.

For more information, visit www.Energent.net.