

Smart Energy Solution for Paper Manufacturing Industry in South Africa

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ABSTRACT

The gas turbine combined cycle, co-generation system and the CHP - Combined Heat and Power - system have both been widely used to improve higher output and higher manufacturing efficiency. The CHP system offers high total thermal efficiency and flexibility of not only electricity but also of steam/hot water, corresponding to a variable heat-electric demand. In this paper, examples of energy solutions are described for the paper manufacturing industry in South Africa using a gas turbine CHP system and the brand new turbine technology, Smart AHAT: Smart Advanced Humid Air Turbine. A technical feasibility study of a 30-MW class gas turbine - Hitachi H-25 - CHP system was undertaken for a paper manufacturing plant in South Africa funded by the Japan External Trade Organisation in partnership with PAMSA (the Paper Manufacturing Association of South Africa). The study confirmed an approximate 20% improvement of plant efficiency compared to the present conventional gas fired system.

The technical feasibility study showed the possibility of

contributing both to the reduction of plant operational costs and CO₂ emissions for ecological future. An AHAT - Advanced Humid Air Turbine - has been developed as a kind of regenerative cycle using a high humidity air. The primary features of the AHAT are high efficiency and excellent operational flexibility, applicable to a high load change rate without a steam turbine such as the combined cycle. The AHAT achieves higher efficiency without increasing the combustion temperature due to high humidity air. Furthermore, the AHAT has a water recovery system and zero (or near zero) make-up water is also expected. The Smart AHAT system has also been proposed as the first commercial model of technology derived from the AHAT system for co/tri-generation use. The key technologies of the Smart AHAT system are a specially designed gas turbine unit, combustion of high humidity air and a water recovery system. The Smart AHAT has a simple configuration and consists of a gas turbine, a HRSG - Heat Recovery Steam Generator - and a WRS - Water Recovery System. The Smart AHAT is expected to not only be another option for the gas turbine CHP system but also to be an innovative system as an energy solution.