Abstract Format

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A Dynamic Optimization Sizing Tool for Waste Heat Recovery-Gas Turbine Inlet Cooling

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Abstract

The benefits of cooling inlet air into gas turbines as a performance enhancement option have been proven to work in practice. The challenges to cool the inlet air are mainly related to the source of energy, the environmental conditions surrounding the plant operations and the contractual-commercial viabilities from generating more power or using less fuel. The choice of available technology to match the operating scenario and environmental conditions can therefore be the turning point for investments in the direction to augment power output or reduce the plant's heat rate. The availability of a dynamic sizing tool which takes into account the time dependent ambient temperatures and the gas turbine operating conditions is key in sizing a system which can deliver the desired cooling at the required time. The ability to carry out sizing with the abovementioned tool would drive the cost of investments down as the oversizing in a typical steady state sizing and selection methodology is based on data averaging.

TNBR has developed a dynamic sizing model for gas turbine applications. The model which is a sizing tool correlates the changing ambient temperatures and plant operating conditions to the workings of an absorption chiller (ABS) technology. The ABS design is driven by waste heat from the gas turbine plant's flue stack through a LiBr phase change process which enables the production of chilled water. The TNBR model links the transient characteristics of the ABS system to the ambient and plant operating conditions and then estimates the amount of available cooling to maintain a target gas turbine inlet air temperature.

A modeling case study carried out for an open cycle gas turbine plant in Putrajaya estimates annual savings of RM 2 million in fuel cost from implementing inlet air cooling for a 120 MW_{th} gas turbine unit. The difference in sizing the absorption chiller package comparing between the TNBR dynamic optimization tool and the typical steady state method is a savings of 20% in capital investments; the savings translates into a simple payback period of less than three years. The model validation was carried out with actual plant data and found to be within a 5% margin.