Optimization of Water Network for Sustainable Water Use in the Steel Industry

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ABSTRACT

The increasing water scarcity and stringent norms on environmental pollution control demand the development of sustainable methods for water use in process operations. The steel plant is one such highly water-intensive industry with a water requirement of 2-4 m^3/ton of steel and the production of 1870 million tons in 2019. Optimum water network synthesis, designed to achieve recycling, regeneration and reuse of water, is one of the ways for sustainable management of water in industries. This study explores several opportunities for water network optimization in the steel industry, through appropriate water flow targeting. Reuse of the blowdown, as well as process loss water as makeup either directly or after regeneration, are explored. These opportunities are evaluated algorithmically using a network superstructure in an optimization framework. The result shows that a 15% saving in annual operating cost and 6% savings on a filtered water requirement can be achieved by the reuse and regeneration of blowdown and process loss water by appropriate recycle assignments. It is further shown here that an additional 3% savings on operating cost and 1.0% savings on a filtered water requirement can also be achieved by optimizing the operating cycles of concentration (COC) of the cooling tower of the cooling systems.

Keywords: Steel plant; Superstructure; Water network optimization; Sustainable development goals.