

A Numerical analysis for total site sensitivity

Abstract

Total Site Heat Integration (TSHI) is an established method for analysis and mapping of heat sources and sinks of multiple processes linked via a centralised utility system. The TSHI method is very beneficial for analysing a total site's sensitivity to plant maintenance shutdown and production changes that affect integrated heat sources and sinks. This paper presents the Total Site Sensitivity Table (TSST) as a systematic approach for exploring the effects of plant shutdown or production changes. TSST can be used hand in hand with TSHI graphical approaches (Grand Composite Curve, Total Site Profile and Site Composite Curve) or numerical approach (Total Site Problem Table Algorithm). The graphical approach provides better insights while the numerical approach provides faster, easier and accurate calculations. Both approaches have its advantages and disadvantages and it is up to the engineers which approach they prefer or complement. The use of TSST allows a design engineer to clearly see the sensitivity of Total Site (TS) towards operational changes. The best setting for different operation condition in total site context can be selected by exploiting this tool. The worst case scenario can also be explored for the integrated TS system through the use of TSST. This information is useful for exploring the individual plant operational flexibility. Decision for having a backup heat exchanger network according to TSST would increase the energy saving for various TS operating conditions. TSST can be used to consider various 'what if' scenarios. They allow the determination of the optimum size of utility generation system and backup piping needed to be designed, external utilities that need to be bought and stored. Application of this technique on a case study demonstrates with the assistance of TS-PTA, TSST clearly pinpoint the effects of plant shutdown or production changes on heat distribution and utility generation systems of a Total Site.