Total Site Heat Integration Targeting Algorithm Incorporating Plant Layout Issues

Peng Yen Liew[a,b*], Sharifah Rafidah Wan Alwi[b], Jiří Jaromír Klemeš[a]
[a]*Centre for Process Integration and Intensification – CPI2, Research Institute of Chemical and Process Engineering - MŰKKI, Faculty of Information Technology, University of Pannonia, Egyetem u. 10, H-8200 Veszprém, Hungary.*
[b]*Process Systems Engineering Centre (PROSPECT), Faculty of Chemical Engineering, Universiti Teknologi Malaysia, 81310 UTM Johor Bahru, Johor, Malaysia.*
pengyenliew@cpi.uni-pannon.hu

Energy Efficiency has gained concern in the process industry due to the high energy consumption. Process Integration using Pinch Analysis plays an important role in enhancing the sustainability and the profitability margin of industrial processes. Total Site Heat Integration (TSHI) is one of the main branches of Process Integration based on Pinch Analysis technique, which is an industrial energy conservation strategy across individual process boundary. However, the pressure drop and heat loss on the steam mains have not been well discussed in the existing Totl Site (TS) targeting methodologies. In this paper, an extended numerical algorithm is proposed for addressing the effects of plant layout to the minimum multiple utility targets. The extended tools are able to assist the designer to perform a preliminary assessment of the retrofit options for a steam system. This enhanced methodology improves the accuracy of the existing TS targeting methodology by considering the effects of plant layout in a TS system.
This improved heat cascade algorithm targets the TS minimum utilities target considering pressure drop and heat losses in the utility system. The pressure drop affects the utility temperature at different locations. The degree of steam superheat is calculated in this methodology to ensure the steam supplied to the heat sink is in fully vapour state. In this methodology several steps are taken: (1) target the theoretical minimum utility requirement, (2) estimate the pressure drop and heat losses, (3) target the minimum utility requirement considering pressure drop and heat loss. This methodology is tested with an illustrative case study, which the indirect heat transfer via utility system is overestimated by 18 % using the existing methodology. The targeting result from the new methodology deviated for 6.37 % (HPS), 53.31 % (LPS), 29.24 % (CW) from the existing methodology. In future research the heat loss for the direct heat transfer HEN should be included and the economic potential is worth to be explored.