

Heat Exchanger Network Modification for Waste Heat Utilisation under Varying Feed Conditions

Jun Yow Yong^{*a}, Andreja Nemet^a, Petar Sabev Varbanov^a, Jiří Jaromír Klemeš^a, Lidija Čuček^b, Zdravko Kravanja^b, Valter Mantelli^c

^aCentre for Process Integration and Intensification – CPI₂, Faculty of Information Technology, University of Pannonia
Egyetem utca 10, Veszprém, Hungary

^bFaculty of Chemistry and Chemical Engineering, University of Maribor, Smetanova 17, Maribor, Slovenia

^cIPLOM SpA, Via C.Navone 3B, 16012 Busalla (Ge), Italy

junyow.yong@cpi.uni-pannon.hu

Waste heat streams are often neglected due to their comparatively low temperatures. However, they can still be utilised by retrofitting existing heat exchanger networks (HEN). Traditionally Pinch Analysis has been used to set heat recovery targets and these can be used as indicators for the retrofit. However, when an existing HEN contains a number of non-optimally placed heat exchangers, major topology modifications may be needed. As a result it may be more economic to achieve heat recovery smaller than the Pinch targets. In some cases exploiting or constructing utility-exchanger heat paths may be too costly and waste heat utilization for added value side-product should be considered. In this paper the problems in retrofitting a HEN for utilities usage reduction are discussed. Additionally, HEN modification analysis is performed aiming at generating hot water as the value-added product. As the operating conditions vary, the modified network should also be flexible. These issues are addressed by a procedure development presented in this work, where different arrangements of HEN for modification are evaluated. The developed methodology is applied to a case study.

This paper has successfully utilised waste heat under different feed conditions. Through a case study, it is determined that waste heat streams have too low temperature to reduce utilities consumption. Attempt to construct heat path for this purpose in this case study will lead to high investment cost. Therefore the HEN is then modified to generate hot water from the waste heat streams instead. The paper discusses different arrangements of heat exchanger and the effects of its flexibility and complexity under different conditions. The HEN in the case study is successfully modified using parallel arrangement. It uses three more heat exchangers with minimum production of 456 kW of hot water. All the heat transfer areas of heat exchangers are determined, which the highest values are used as the basis for design.