

## Targeting of the Trade-Off of Capital Cost and Carbon Footprint for CHP

Petar Sabev Varbanov<sup>a\*</sup>, Stanislav Boldyryev<sup>b</sup>, Andreja Nemet<sup>a</sup>, Jiří Jaromír Klemeš<sup>a</sup>, Petro Kapustenko<sup>c</sup>

<sup>a</sup>Centre for Process Integration and Intensification – CPI<sub>2</sub>, Research Institute of Chemical and Process Engineering- MÜKKI, Faculty of Information Technology, University of Pannonia, Egyetem u. 10, H-8200 Veszprém, Hungary, varbanov@cpi.uni-pannon.hu

<sup>b</sup>National Technical University “Kharkiv Polytechnic Institute”, Frunze str. 21, 61002 Kharkiv, Ukraine, stasboldyryev@gmail.com

<sup>c</sup>AO "SODRUGESTVO-T", Krasnoznamenny per. 2, off. 19, 61002 Kharkiv, Ukraine

### Abstract

Industrial sites spend large amounts of energy emitting consequently considerable CO<sub>2</sub> emissions. Heat recovery at Total Site provides one option for energy saving. A related option is the on-site power co-generation. This work provides an estimation of the trade-off of capital cost vs. Carbon Footprint for combined heat and power generation for a set of specified steam pressure levels at the stage of Total Site targeting. The previous work on targeting co-generation potential and R-Curve analysis has been extended with analysis of cost and Carbon Footprint consideration.

**Keywords:** Total Site Integration, CHP, Capital Cost, Carbon Footprint

### References

- Čuček L, Klemeš, J.J, Kravanja Z., 2012, A Review of Footprint Analysis Tools for Monitoring Impacts on Sustainability, *Journal of Cleaner Production*, 34, 9-20.
- A. Ghannadzadeh, S. Perry, R. Smith, 2012, Cogeneration targeting for site utility systems, *Applied Thermal Engineering*, 43, 60-66.
- C.W. Hu, S. Ahmad, 1994, Total site heat integration using the utility system, *Computers & Chemical Engineering*, 18, (8), 729-742.
- J. Klemeš, V.R. Dhole, K. Raissi, S.J. Perry, L. Puigjaner, 1997, Targeting and Design Methodology for Reduction of Fuel, Power and CO<sub>2</sub> on Total Sites, *Applied Thermal Engineering*, 17, (8-10), 993–1003.
- J. Klemeš, F. Friedler, I. Bulatov, P. Varbanov, 2010, Sustainability in the Process industry – Integration and Optimization. McGraw-Hill, New York, USA
- J.J. Klemeš, P.S. Varbanov, 2012, Heat integration including heat exchangers, combined heat and power, heat pumps, separation processes and process control, *Applied Thermal Engineering*, 43, 1–6.
- H. Kimura, X.X. Zhu, 2000, R-Curve concept and its application for industrial energy management, *Ind Eng Chem Res*, 39, 2315–2335
- A. Nemet, P.S. Varbanov, P. Kapustenko, S. Boldyryev, J.J. Klemeš, 2012, Capital Cost Targeting of Total Site Heat Recovery, *Chemical Engineering Transaction*, 29, 1447-1452.
- A. Poullikkas, 2005, Operating cost and water economy of mixed air steam turbines, *Applied Thermal Engineering*, 25, (13), 1949–1960.
- M. Sorin, A. Hammache, 2005, A new thermodynamic model for shaftwork targeting on total sites, *Applied Thermal Engineering*, 25, (7), 961-972.
- R. Smith, 2005, *Chemical process design and integration*, Chichester, UK, Wiley.
- A. Stoppato, G. Mirandola, E. L. Meneghetti, 2012, On the operation strategy of steam power plants working at variable load: Technical and economic issues, *Energy*, 37, (1), 228–236.
- P. Varbanov, S. Perry, Y. Makwana, X.X. Zhu, R. Smith, 2004, Top-level Analysis of Site Utility Systems, *Chemical Engineering Research and Design*, 82, (6), 784-795.
- P.S. Varbanov, Z. Fodor, J.J. Klemeš, 2012, Total Site targeting with process specific minimum temperature difference ( $\Delta T_{\min}$ ), *Energy*, 44, (1), 20-28.