Title: Integrating Renewables into Multi-Period Heat Exchanger Network Synthesis Considering Economics and Environmental Impact

Author: Adeniyi J. Isafiade Michael Short Milos Bogataj Zdravko Kravanja

PII: S0098-1354(16)30351-9
DOI: http://dx.doi.org/doi:10.1016/j.compchemeng.2016.11.017
Reference: CACE 5606

To appear in: *Computers and Chemical Engineering*

Received date: 21-2-2016
Revised date: 10-11-2016
Accepted date: 11-11-2016

Please cite this article as: Isafiade, Adeniyi J., Short, Michael., Bogataj, Milos., & Kravanja, Zdravko., Integrating Renewables into Multi-Period Heat Exchanger Network Synthesis Considering Economics and Environmental Impact.*Computers and Chemical Engineering* http://dx.doi.org/10.1016/j.compchemeng.2016.11.017

Integrating Renewables into Multi-Period Heat Exchanger Network Synthesis Considering Economics and Environmental Impact

Adeniyi J. Isafiade*[a], Michael Short[a], Milos Bogataj[b], Zdravko Kravanja[b],

[a]Department of Chemical Engineering, University of Cape Town, Private Bag, Rondebosch 7701, South Africa
[b]Faculty of Chemistry and Chemical Engineering, University of Maribor, Slovenia

*Corresponding author: (A.J. Isafiade)
Tel: +27 21 650 4869; E-mail address: aj.isafiade@uct.ac.za

Highlights

- A multi-season and multi-period stage-wise superstructure model is proposed
- Model integrates renewable and non-renewable energy into process heat demand
- Gives best combination of utilities based on economics and environmental impact

Abstract

This paper presents a further development of synthesis methods that considers economics and environmental impact in the integration of renewable energy into the optimisation of heat exchanger networks involving multiple periods of operations and multiple options of utilities. The multi-period process stream parameters, and those of the utility sources are integrated in a systematic approach using an expanded version of the simplified stage-wise superstructure multi-period model. Two examples were used to demonstrate the benefits of the expanded synthesis method and the quality of solutions obtained were judged by representation on a Pareto curve and by the use of a modified goal solution method. It was found that various combinations of utility sources were selected for use at various periods/seasons of operations, while utilities from solar photovoltaic were not selected for use at any of the periods/season of operation due to its relatively high cost and limited periods of availability.

Nomenclature

Abbreviations

ACI	Area cost index
AF	Annualisation factor
EI	Environmental impact
EMAT	Exchanger minimum approach temperature
HENS	Heat exchanger network synthesis
LP	Linear programming
MILP	Mixed integer linear programming
MINLP	Mixed integer non-linear programming
NOP	Number of periods
NOS	Number of seasons
SWS	Stage-wise superstructure