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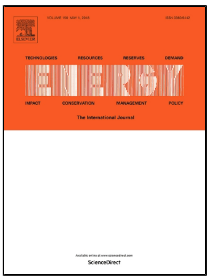

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Multi-Period Energy Targeting for Total Site and Locally Integrated Energy Sectors with Cascade Pinch Analysis

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ABSTRACT

Total Site (TS) analysis for incorporating short-term or daily energy variation has been introduced in the previous studies as an extension of the Time Slice Model for the Heat Integration of batch processes. However, the energy supply and demand fluctuation could also be affected by changing customer demands due to seasonal climate variations, economic downturn, maintenance, plant turn-around, plant operability issues and raw material availability. This paper extended the cascade energy targeting methodology for TSHI incorporating long- and short-term heat energy supply and demand variation problem. The methodology aims to estimate the energy requirements of the TS system considering seasonal energy storage system as a feasibility study for energy efficiency project. A newly extended algebraic tool, known as Seasonal Total Site Heat Storage Cascade (Seasonal TS-HSC), is introduced in the methodology for modelling the energy flow between process units and storage facilities. The general tool could be used for different storage systems. This proposed tool includes the estimation of energy losses through self-discharge, charge and discharge process based on the energy storage system performance. The methodology is illustrated by a case study, which integrates batch processes, community buildings and space heating system. Implementation of the developed methodology on the case study resulted in 93.4 % (low-pressure steam - LPS) and 38.2 % (hot water - HW) heating requirement reduction via seasonal energy storage system application at two utility levels. The result shows the energy requirement reduction, which contributes to profitability margin improvement, greenhouse gas emission