



## Fired heater integration into total site and multiple fired heater targeting

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### ABSTRACT

Energy integration of fired heater into the process helps to target minimum fuel and air preheat temperature prior to the detailed design. In this paper a procedure is presented for the integration of fired heater into the total site leading to overall energy saving. The procedure helps to target the fired heater parameters such as, fuel firing and air preheating, for a site integrated directly or indirectly. A procedure for targeting the minimum number of fired heater and the heat duty is also presented for a site with multiple fired heaters. A method is proposed to improve the fired heater efficiency of indirectly integrated site, where steam is the intermediate fluid for transferring heat across the processes.

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### 1. Introduction

Fired heaters, also known as process heaters, direct-fired heaters and process furnaces in process industries, supply specified quantity of heat at an elevated temperature to various process streams. Fired heaters are used in various chemical and process industries for directly heating process streams. The hot flue gases of combustion transfer heat to process stream flowing inside the fired heater tubes. Typically, the fuel firing rate is controlled to achieve the stream target temperature.

Hot utility requirement of a process can be determined from the overhang of the cold composite curve over the hot composite curve or from the grand composite curve (GCC). Hall and Linnhoff [1] as well as Varghese and Bandyopadhyay [2,3] have already reported the procedure for integrating fired heater into the process. Fuel firing, air preheat temperature and excess air are assumed to construct the utility grand composite curve (UGCC). The UGCC with flue gas and air preheating is matched against process GCC to form a utility pinch. The corresponding fuel firing and air preheat temperature are the targets for the fired heater integrated. An analytical procedure for the integration of fired heater into process has been reported by Varghese and Bandyopadhyay [2,3]. The procedure helps to target fired heater fuel firing, air preheat temperature using process heat below pinch and using flue gas heat

analytically. It has been reported that a fired heater integrated against process GCC require less fuel compared to the composite curve based targets [1–3]. In certain cases the process may require multiple fired heaters to supply the hot utility required. In such cases it is important to estimate the minimum number of fired heaters required. Varghese and Bandyopadhyay [3] have reported a methodology to target the minimum number of fired heaters and their heat duties for a process prior to the synthesis of the heat exchanger network.

The concept of total site was introduced by Dhole and Linnhoff [4] to describe a set of processes serviced by and linked through a central utility system. Total site integration of independent processes or plants can provide more energy saving opportunities. Processes with different pinch temperatures offer the potential for energy saving through total site integration. In total site integration of processes, the direct integration offers maximum energy benefits; however it may involve complex networking, less flexibility and economic constraints. On the other hand indirect integration with steam or hot oil as intermediate fluids transferring heat from one process to the other, offers greater advantages of flexibility and better process control with an associated energy penalty [5].

For integrating the processes directly, the site grand composite curve (SGCC) can be constructed using a combined problem table algorithm of the site processes. In the indirect method for integration an intermediate fluid is used to transfer heat across processes. The use of an intermediate fluid reduces the interval of effective heat transfer (between pinches) by a multiple of the minimum temperature difference. Bandyopadhyay et al. [6] have described a method to construct the SGCC for the indirect integration of processes. Using the procedure total site hot utility and

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