



Total Site Integration for Coke Oven Plant

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Ukraine is one of the most energy-intensive countries in the region. The most important point is reduction of energy consumption in chemical and metallurgical industries, where energy price is a basic component of production costs. The process of benzene distillation and process of coal tar distillation, which is typical for East European countries, is analyzed in this paper. The observed process media is crude benzene, what is a complex mixture of chemical (aromatic) compounds, the most important of which are benzene hydrocarbons (benzene and its homologues), and their content is about (80-90) %. Crude benzene contains inorganic and sulfur compounds, phenols, pyridine compounds, etc. as impurities. When capturing benzene hydrocarbons from coke gas by absorption oils, crude benzene contains light distillates of absorption oil and naphthalene. The data for process streams were collected, and it allowed applying the Pinch Integration methodology for the reconstruction of two benzene departments and the tar distilling shop with common supply stream.

The Pinch Analysis method was selected to perform a reconstruction project. According to principles of pinch analysis, new network diagrams are designed and capacity of heat-exchange equipment is calculated. The using of «Total Site Profiles» showed the feasibility of heat pump integration. Heat pump integration allowed to reduce the external hot utilities usage on 368 kW and cold utilities usage on 368 kW. This project let to decrease the external hot utilities usage on 23 % and cold utilities usage on 24,13 %, and also offered the way of step-by-step retrofit of the plant.

The ability of install the heat pump was analysed using Total Site Profiles. The coefficient of performance for the heat pump has been obtained by using UniSim Design program. The installation of the heat pump allowed to reduce the external hot utilities usage by 2597.15 kW and cold utilities usage by 2597.15. Total Site Profiles shows the possibility for heat pump integration. As can be seen from the calculations, in order to achieve targets values compressor capacity should be increased by 3.1 kW.

The proposed project allows to decrease the external hot utilities usage by 23 % and cold utilities usage by 24,13 %, and also offered the way of step-by-step retrofit of the plant. The using of «Total Site Profiles» showed the feasibility of heat pump integration. Heat pump integration allowed to reduce the external hot utilities usage by 368 kW and cold utilities usage by 368 kW. Capital costs – 666230 US Dollars, Present Value –635124.5 US Dollars / year, Pay-Back Period - 1.04 year.

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