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Heat integration improvement for Eastern European countries sugar-plant

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The integration into world economy is accompanying by the considerable change of the prices structure with the leading increases of energy recourses price. Therefore, to maintain the competitiveness of acting sugar plants is impossible without their retrofit with a view of energy consumption improvement and decreasing of the energy consumption part in production cost.

The case study is presented for sugar plant with output 3000 tons of sugar-beet per day in this paper. The flowsheet of the production is typical one for Eastern Europian countries and includes the continue convection process with the press water return, the limed – carbonic cleaning of convection juice (which consist of progressive preliming, hot and cold main liming, first saturation, filtering, liming before second saturation, second saturation and sulfitation), the juice thickening by evaporation and three stage of crystallization with of third crystallization sugar affination.

The process of beet-sugar production on the investigated plant consists of three technologically and regionally separated parts: beet-sugar processing, juice purification and product stage. In this article we study the heat integration of the beet-sugar processing and juice purification stages with the partial inclusion into integration the product stage technological streams. As a result in the integration include 23 streams.

The plant inspection showed that in the existing heat network ΔT_{min} = 8.5 °C, and Pinch locates on streams with change of phase. It shows that there is no possibility to

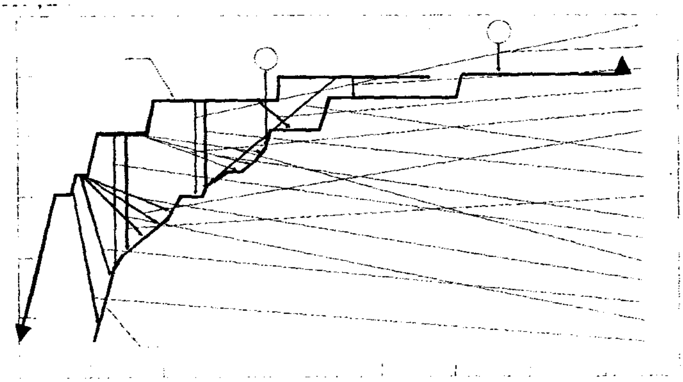

Figure. The composite curves for sugar producing process and matches presentation at the curves. 1 – hot composite curve; 2 – cold; VE – evaporative vacuum pan; S1 – evaporative stage 1; S2 – stage 2; S3 – stage 3; S4 – stage 5; S5 – thickener; T1 – T4, T6 –T9 – recuperative heat exchanger; DA – diffuser; BC – barometric condenser; H – hot utility identically determine the power of the consumption utilities using the Composite Curves building (Figure). As results of study, in the heat network were detected two heat exchangers transferring the energy across Pinch, one of them is the utility one and other is recuperative one. The heat load on these heat exchangers and the load of the first evaporator tank are known, and it allowed to determine the heat load of hot utilities the existing heat flowsheet, which is equal to 51.5 MW (Figure). It is discovered the big criss – crossing heat transfer in the heat network and the range of other bottlenecks, for example, the considerable under heating of thin juice before first evaporator stage.

Using the Pinch methods techniques there is developed the range of energy saving actions for serial retrofit of the plant. On the first stage the heat transfer across Pinch is excluded and the bottlenecks are eliminated. Because of it the energy consumption decreases on 16 %. The pay-back period of the retrofit first stage does not exceed the term of one beet-sugar productive campaign. On the second stage owing to additional technological streams integration the energy consumption is decreases on 30 % from the existing level. The retrofit on the second stage is realized at the expense of profit received after primary retrofit.

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