STEP 1.5 CASE STUDY

Analysis of priority flows

In an Egyptian potato processing company, raw material and energy were identified as priority flows. The TEST team prepared mass and energy balances to identify the focus areas. The mass balance revealed that 80% of the raw material weight was lost in the fryer section. The energy balance identified thermal energy as the priority energy flow, and a Sankey diagram was prepared to illustrate the breakdown of thermal energy by key users. The diagram revealed that most of the thermal energy was consumed to evaporate moisture from the potatoes at the fryer, followed by the thermal energy used at the blancher. Both the mass balance sheet and Sankey diagram are presented in figure 1.

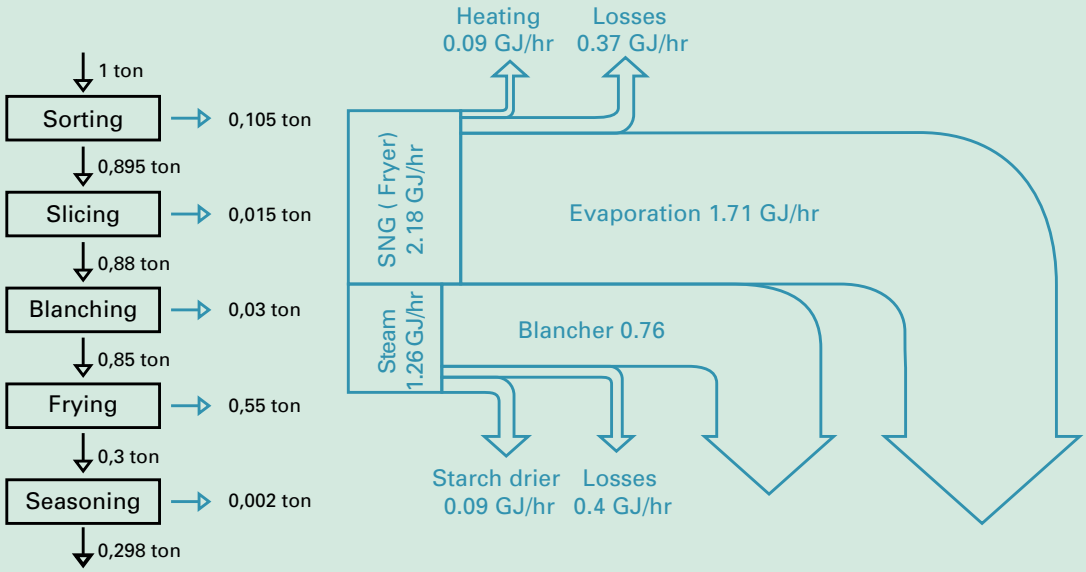

Figure 1 Raw material (potato) mass balance and thermal energy balances (Sankey diagram) of key energy users (fryer and blancher)

At the project's start, it was a challenge to detect raw material losses, as no significant waste was noted along the production line during the walkthrough (step 1.1). All the losses appeared to be already minimized and the production hall was perfectly clean. As for energy, the initial audit of the utilities focused on the boiler in terms of insulation and condensate recovery. Thanks to the mass balance implemented in Step 1.5, the team gained better insights leading to the identification of the frying section as the priority area for material losses. The Sankey diagram revealed that significant energy users are the fryer and the blancher. The energy used by these two processes was 8 times higher than the energy losses of the boiler and steam pipelines together.

»... this solution led to the environmental benefit of decreasing the CO2 emissions as well as air pollution ...«

When the TEST team was informed about the key findings (in Step 1.6), they underlined that the losses in the fryer are "natural loss", due to the high water content (generally around 80% in weight) in the raw potatoes. The energy used for evaporation of potato water content is lost in the form of latent heat and released to the environment through the fryer chimney. The calculation of the energy content in the vapor revealed the largest energy carrier within the company boundary.

Following in-depth investigations and several unsuccessful discussions to tackle the first and second tiers of options (eliminate the source of loss, reduce the source of loss) or to find alternatives for reducing the losses of raw material, the team investigated the third tier for options generation (recycle/reuse). The availability of latent heat in the fryer emissions, which is almost 2.5 times the energy needed by the blancher, highlighted the possibility of recovering energy from the fryer and using it in the blancher. It was found to be feasible to send the vapor from the fryer chimney through a heat exchanger and use the recovered heat in the blanching process.

This measure reduced the company's energy consumption by cutting the steam demand from the blancher. In addition, half the energy losses of the steam generation and distribution system were reduced. It also decreased the demand for boiler feed water, with all its associated softening chemicals, and feed-pump electricity consumption. Further to the economic savings, this solution led to the environmental benefit of decreasing the CO^2 emissions as well as air pollution in the form of odors released through the chimney.