

PROJECT NAME	Steam management system in refining energy
LOCATION	Rijeka Refinery
DURATION	2014 – on going
OUTCOME	Energy savings and CO2 emission decrease by \approx 2%

Project Description

▶ BACKGROUND

Energy intensive production processes are the main characteristics of oil refineries. Reports suggest that refinery energy consumption represents between 43 % (US Energy Administration) and 60 % (Conservation of Clean Air and Water in Europe) of refinery operative costs. This trend has become more important as a result of energy costs increase and new demands for product quality which resulted in increase complexity of production process. Analysis show that the most used energy source in refineries is heat, with a portion of 80 % in the overall energy expenses.

Steam production in Rijeka Refinery exceeds 30 % of overall energy consumption. In the original process design, after heat transfer from steam to streams in production process, condensate (water) is drained to process sewage. Condensate temperature is in the best case around 100°C and condensate drain results in energy loss and related CO2 emissions. Additional cost is the result of steam losses due to broken steam traps.

Demi water for steam production has to be prepared by chemical treatment of raw water with related energy consumption. For continuous production process, condensate loss in sewage and steam loss at steam traps has to be replaced with the same amount of treated water, and the result is new energy and chemical consumption.

Modern, high efficient closed systems are based on condensate collecting and recovery of available waste heat. Such system minimizes water, energy and chemicals consumption, resulting in improved Energy, Ecology and Economy performance of the refinery.

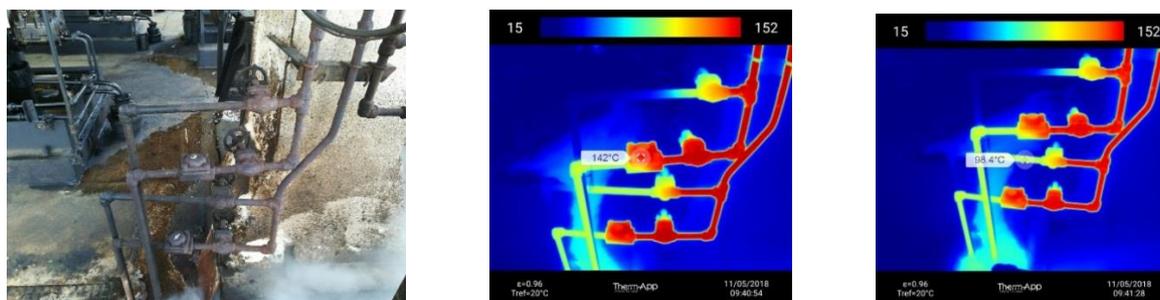


Fig. 1 Old system – Condensate flows to sewage system

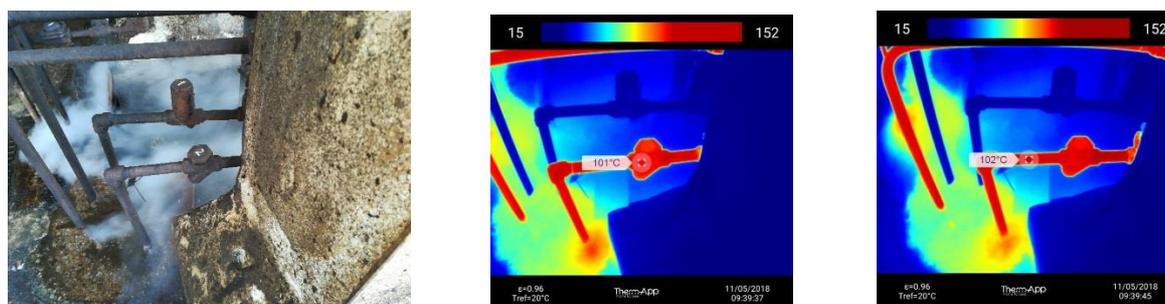


Fig. 2 Old system – In case of broken steam trap, steam flows directly to environment

► HISTORY

Because of the significant influence of steam management to Energy, Ecology and Economy performance indicators of the refinery, related analysis and saving proposals preparation are a continuous process. Due to a big steam distribution system and lack of data about steam traps, it is very difficult to initiate projects and prepare all necessary calculations and targets. As a result of this situation, steam management in Rijeka Refinery was divided into two projects:

- Steam trap data collection, testing and data base preparation,
- Condensate collecting system implementation.

The target of the project “Steam trap data collection, testing and data base preparation” is identification, testing and data collection about all steam traps in the Refinery. Testing has been conducted by using modern ultrasound technology. Prepared data-base is going to be the data source for all future activities regarding steam management.

In the scope of the project “Condensate collecting system implementation” state of the art closed condensate collecting system was installed, which minimizes condensate loss, water chemical treatment and energy loss. Figure 3 shows central condensate collecting station with heat exchanger and condensate tank, and figure 4 shows condensate manifold with steam traps as the main on site equipment of system.



Fig. 3 Central condensate collecting station with heat exchanger and condensate tank

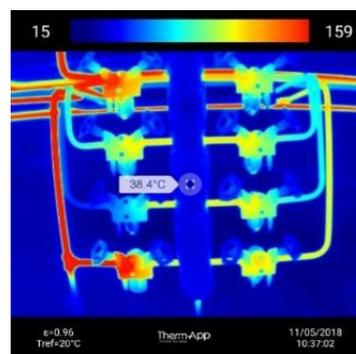


Fig. 4 Condensate manifold – new condensate collecting system

Project Results

► MAIN RESULTS AND OUTCOMES (WHAT CHANGED?)

The scope of this project has covered 5,200 steam traps. The researched showed that about 16 % of analysed steam traps were broken, 34 % is are not needed and about 50 % are functioning in parameters. Collected data is stored to a data base and will be a very important source of information for future technical and economic calculations.

The condensate collecting system in Rijeka Refinery has been in operation since 2016. Results are very positive: in 2016 147,000 t of condensate was collected, which resulted in fuel oil savings of 6,317 t and CO₂ emission decrease by 20,024 tCO₂. Results realized in 2017 are presented in Table 1.

Table 1 Condensate collecting system implementation – results:

	Total energy consumption [TJ]	Total CO ₂ emission [tCO ₂]	Collected condensate [t]	Fuel oil consumption decrease [t]	CO ₂ emission decrease [t]
2016	12,954	986,250	147,000	6,317	20,024
2017	14,618	982,024	227,760	6,775	21,479

The energy savings for 2017 represent about 1.88 % of total energy consumption in Rijeka Refinery, and up to 1.13 % of operative costs. On the other hand, as a result of this project, Rijeka Refinery CO₂ emission in 2017 decreased by 2.1 % in comparison to total annual emission (982,084 tCO₂). The financial result of this project is presented in table 2.

Table 2 Condensate collecting system implementation – financial savings

	Price of fuel oil (FOB MED) [USD/t]	CO ₂ allowance price (EUA&CER) [USD/t]	Total savings [USD]
2016	291	5.43	1,946,977
2017	350	6.80	2,517,307