

Tupras Refinery Improves Crude and Vacuum Distillation Unit Mass Balance with Emerson's Coriolis Flow Meters

RESULTS

- Unit mass balance significantly improved to consistently being within $\pm 1\%$
- Coriolis flow meters were selected to be the meter of choice for mass balance projects after engineering studies were conducted by the refinery team
- Improved measurement on charge and yield streams resulted in more reliable data to make better optimization decisions



APPLICATION

Calculating process unit mass balances is the first step for monitoring the performance of a process unit. Having an accurate measurement of the charge and yield rates across a unit has many benefits.

An accurate process unit mass balance makes it possible to analyze and optimize fractionator cut points, monitor catalyst performance, improve feedstock purchasing decisions, and perform post audits to calculate and validate the payback for capital investments. Refineries typically target a unit mass balance of $\pm 2\%$. Reaching this target provides quality data that can be used for improved optimization and better operational decisions.

The accuracy of the mass balance of the crude unit is especially critical because it is the first processing unit of the refinery and sets the measurement basis for all downstream units and production targets.

CUSTOMER

Tupras Refinery

CHALLENGE

The Tupras Izmit Refinery management team worked with Emerson experts to identify key opportunity improvement areas around safety, reliability, energy efficiency, and production optimization during a Top Quartile Performance Consulting Workshop. One of the prioritized improvement areas that came from that workshop was improving the crude and vacuum distillation process unit mass balances. Tupras, like many refiners primarily used orifice flow meters to measure the input and output streams to and from the crude unit. They also had a liquid ultrasonic insertion meter for one of their measurement points. These volumetric meters contributed significant inaccuracies to the mass balance because these meters are impacted by changing process

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conditions and crude slates. With the current measurement system, the data was showing more mass coming out of the unit than what was inputted. In addition, the unit had some high temperature streams and limited installation space that made technology selection a challenge.

SOLUTION

The Tupras team prioritized certain mass balance points they wanted to improve. They chose to replace the orifice meters and liquid ultrasonic insertion meter as well as add some additional measurement points. Ten Emerson Micro Motion® ELITE® Coriolis flow and density meters were implemented in the Crude and Vacuum Distillation Units.

Coriolis flowmeters can significantly improve balances by measuring direct mass and online liquid density. The accuracy of Coriolis flowmeters is independent of the flow stream profile, process conditions, and fluid composition changes. Because Coriolis flowmeters are not dependent on the profile of the flow stream, there are no straight run or flow conditioning requirements making them easy to install which was an important factor in the project. For future process development, Tupras also wanted high temperature meters to withstand and operate at temperatures of 400°C (752°F). Emerson supplied ELITE High Temperature Coriolis flow meters to meet these requirements. The refinery team also worked with Emerson flow measurement experts to verify meter sizing, identify available space to install the meters, and to develop a steam cleaning procedure for the meters. Furthermore, Tupras worked with Emerson flow measurement experts to define operational and measurement practices for using Coriolis flowmeters to measure highly viscous product streams from the Vacuum Distillation Unit.

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