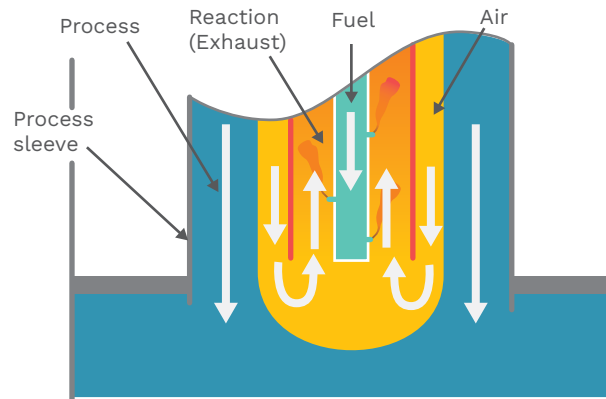


Direct Heating Unit (DHU) Technology

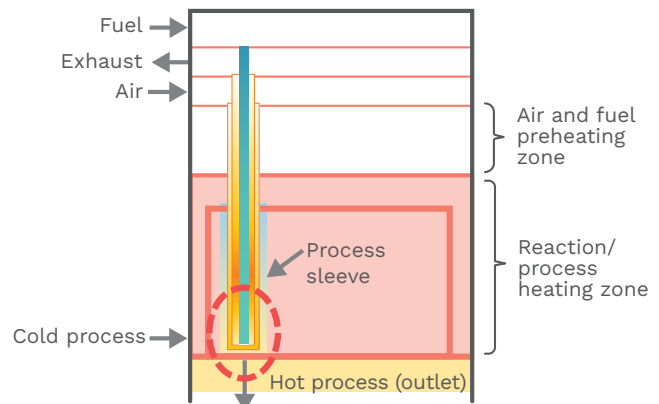
Direct Heating Unit (DHU) Technology is an innovative improvement to the styrene industry. This technology combines the function of a steam superheater cell and a reheat exchanger, and results in improved operations and safety, and longer equipment life. _____

The DHU technology decouples the steam required for the styrene catalyst from heat transfer considerations, which lowers temperatures and facilitates a reduction in steam consumption. Instead of using a fired heater, a simple axial flow heat exchanger with multiple sets of concentric tubes is used, thereby simplifying the styrene unit's complex controls and resulting in easier operations and a safer design.

Pipe Arrangement



DHU Tubular Design





Commercial Experience

- Demonstration unit at TotalEnergies SE
 - Operation using real process streams
 - 14,000 hours of operation
- Videolar-Innova, S.A.
 - Revamp Project
 - 2019 Start-up
- Yeochun NCC Company, Ltd.
 - Revamp Project
 - 2019 Start-up

DHU Technology Highlights

Benefits:

- Simplified operation
- Easy to start-up
- Responds quickly to changes in operation
- Fewer high temperature pipes
- Decouples the steam required for the catalyst from heat transfer considerations
- Smaller plot space
- Less pressure drop for both steam and process
 - Replaces a fired heater with a heat exchanger which results in fewer unplanned shutdowns and less maintenance



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