

# THE HEAT

## Heat Exchanger Fleet Improvements for Energy Efficiency of Crude Distillation Units

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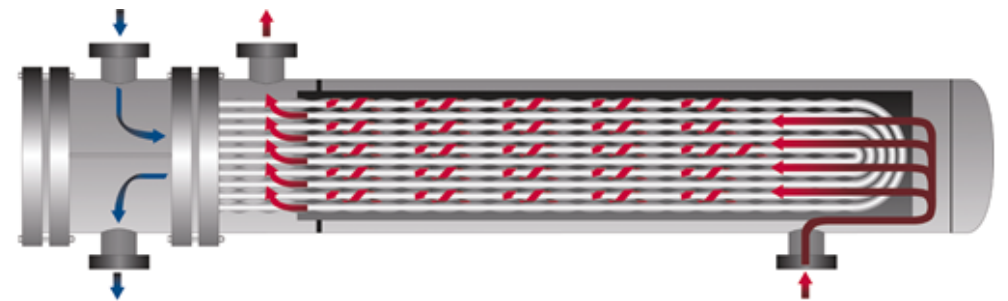
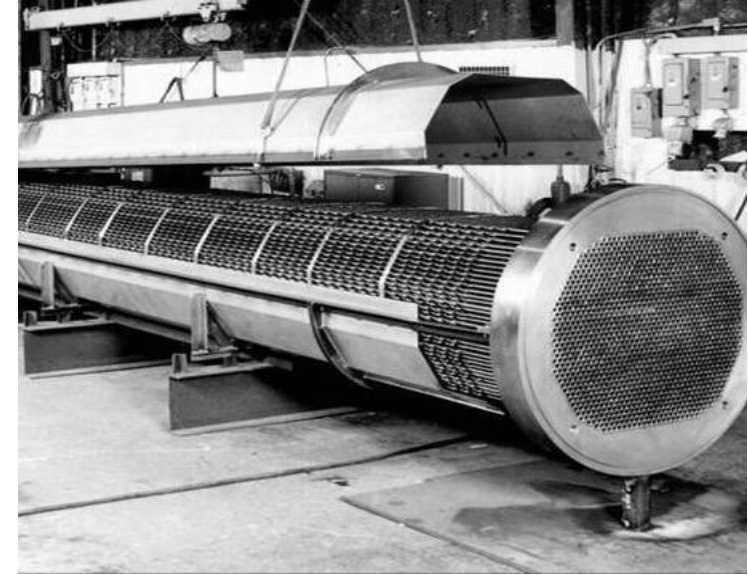
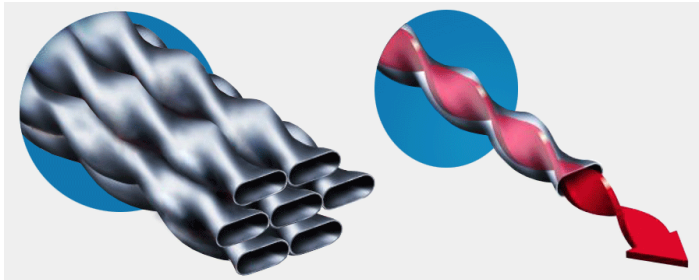
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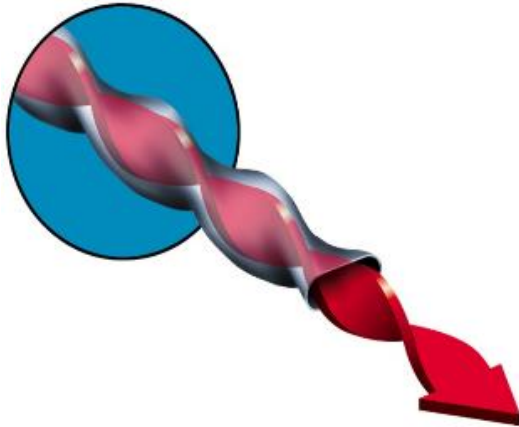
## TWISTED TUBE® Heat Exchanger

- Provide improved heat recovery, increased throughput, reduced pressure drop and elimination of vibration from existing installations.
- Improve heat recovery from feed preheaters (crude oil, hydrotreating & reforming) resulting in lower energy costs and emissions from fired heaters located downstream.



### Key to Maximizing Energy Recovery (Q)

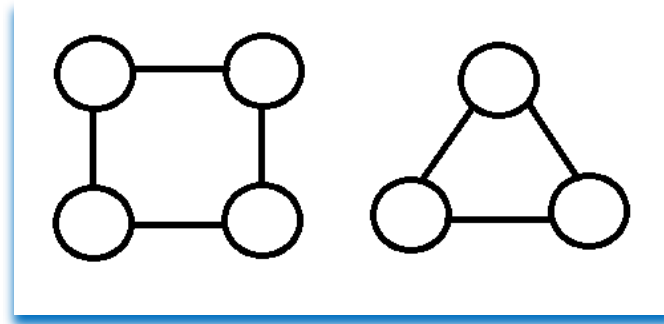
$U_o$



*U value increase due to the unique shape of the tube*

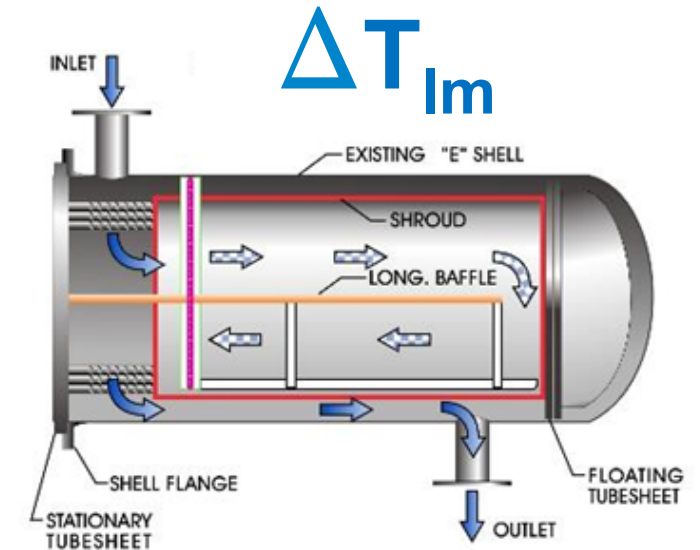
$A$

$\times$



*Surface area increase by changing tube pitch and pattern while maintaining cleanability*

$\times$



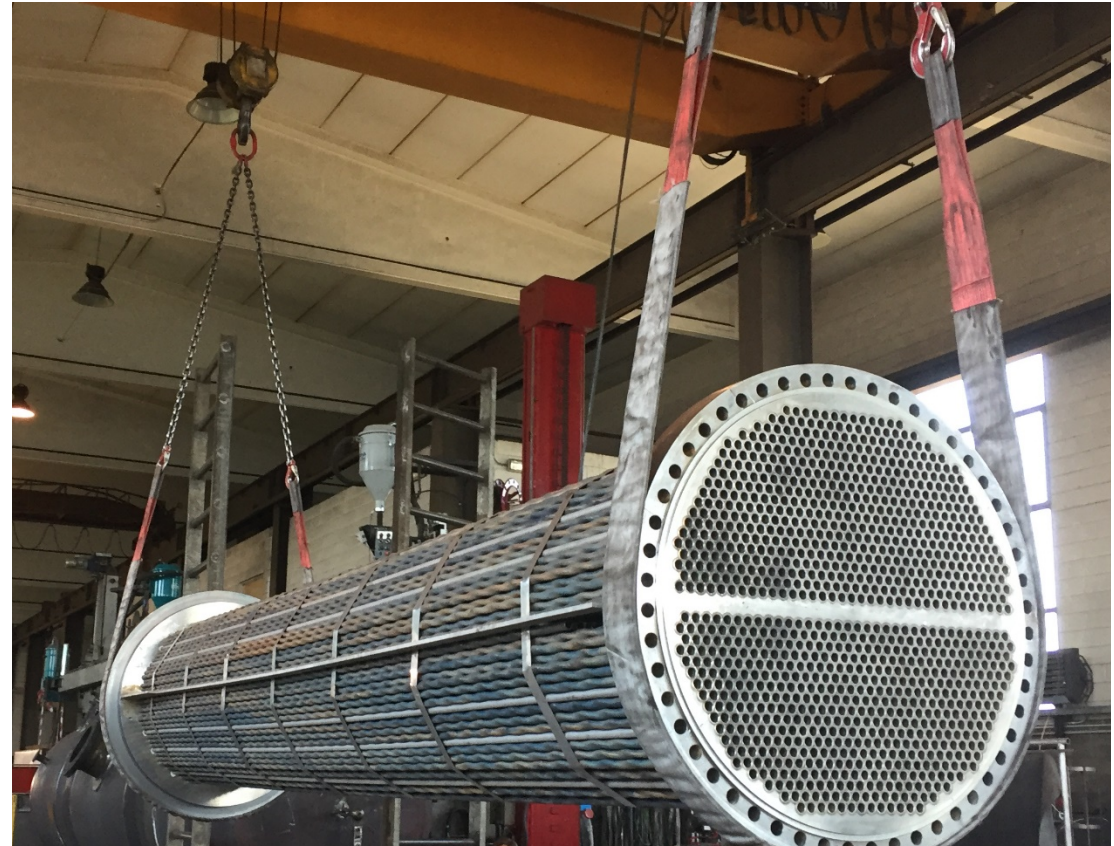
*Temperature difference (driving force for heat transfer) maximized by pure countercurrent flow*



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## TWISTED TUBE® Heat Exchanger: Disassembly

- Step 1: Shroud Removal

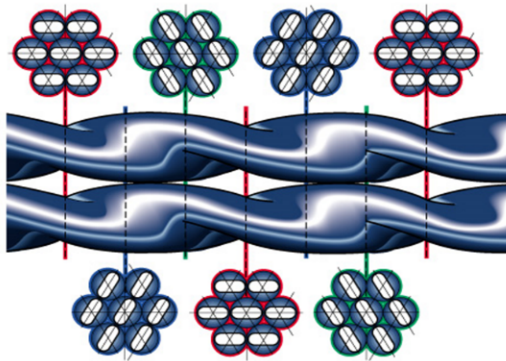
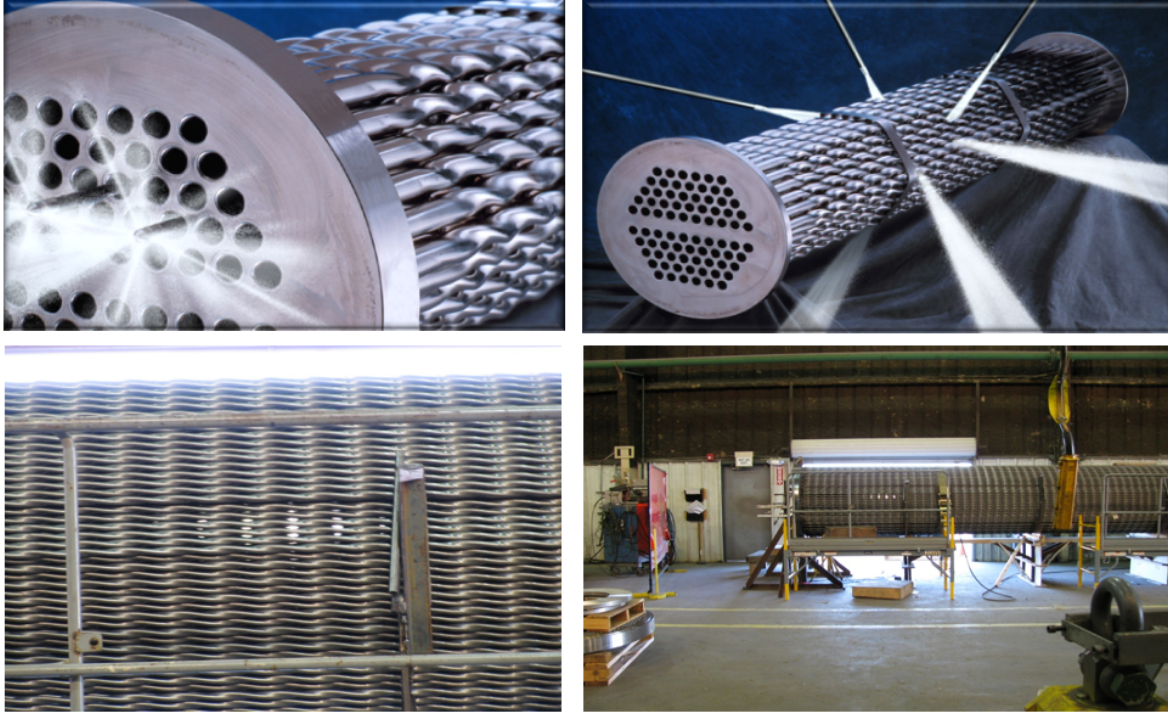


- Step 2: Place slings at stationary and floating tubesheets.
- Step 3: Move bundle to cleaning area



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## TWISTED TUBE® Heat Exchanger: Cleaning



### Tube Side Cleaning

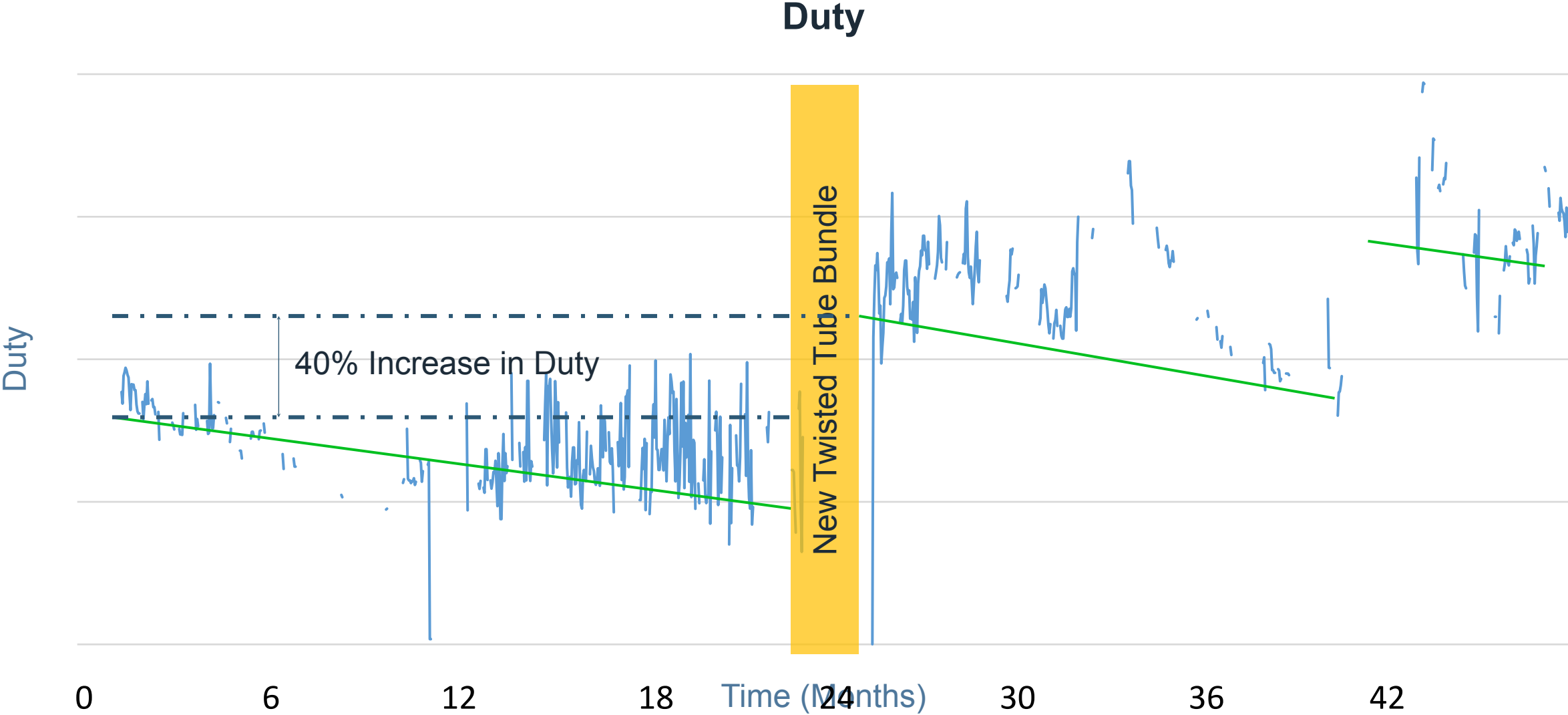
- No special tooling required
- Correct diameter lance/nozzle
- Multidirectional jet nozzle recommended with high pressure
- Cleaning effectiveness – function of pressure and volume

### Shell Side Cleaning

- Cleaned by hydroblasting using six cleaning lanes
- For bundles with a longitudinal baffle, recommended that first and final hydroblast be performed parallel to the baffle.

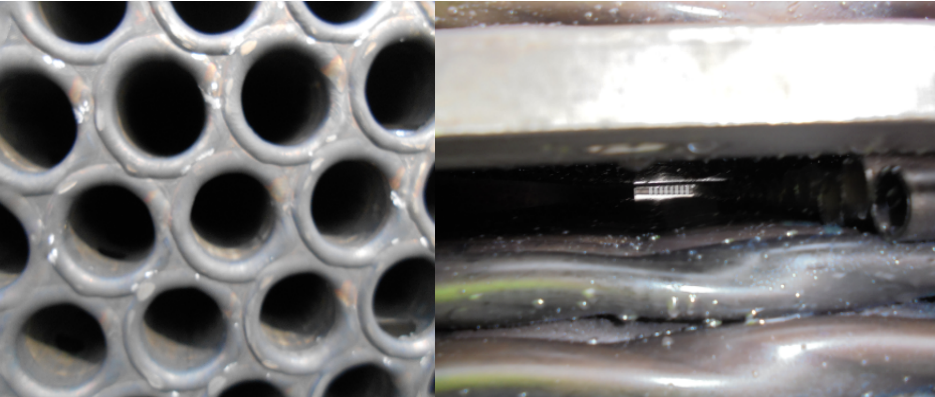
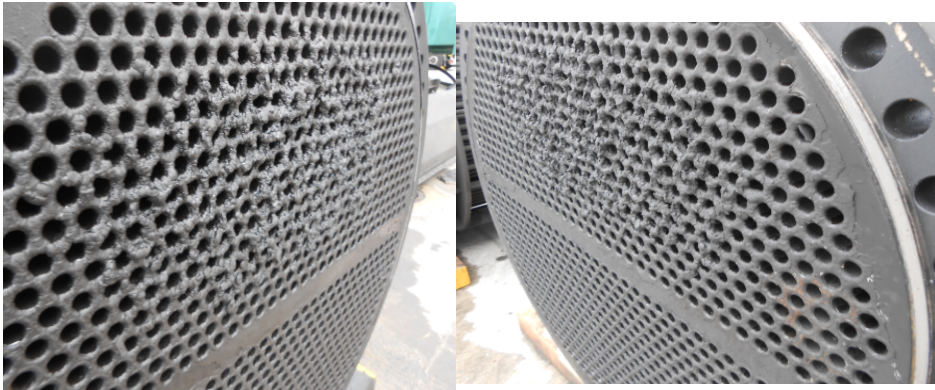
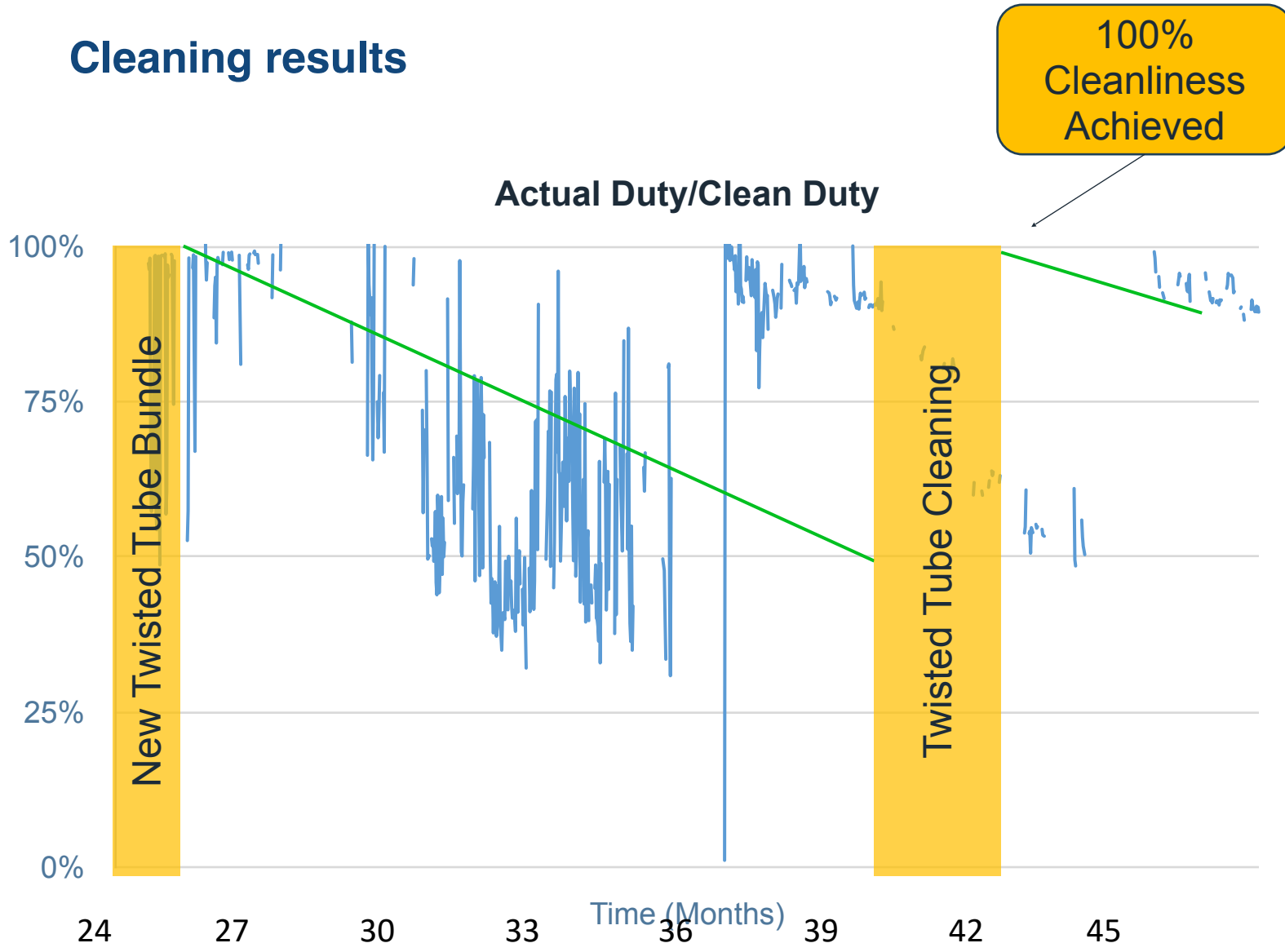
# Heat Exchanger Fleet Improvements for Energy Efficiency of Crude Distillation Units

## Performance results



# Heat Exchanger Fleet Improvements for Energy Efficiency of Crude Distillation Units

## Cleaning results





# Heat Exchanger Fleet Improvements for Energy Efficiency of Crude Distillation Units

## Managing the Heat Exchanger Fleet

### Call to Action:

- Aging global heat exchanger fleet (~40k HXs) with continuous performance degradation
- Increasing profitability, efficiency, and reducing GHG

### Management and Methodology:

- Leveraging data analytics to identify opportunities for performance improvement
- Deploying differentiating technology to transform fleet performance
  - Upgrade technology when replacing end-of-life bundles
  - Upgrading existing equipment versus installing new infrastructure

Carbon steel tube bundle > 40 yrs service



