Shell distillation service visits
Identifying opportunities to improve distillation unit performance

A distillation service visit by Shell Global Solutions’ consultants is valuable in helping to identify opportunities for improving the performance of distillation facilities. Previous studies have identified margin improvements of 4 to 20 cents per barrel of crude intake, with little or no investment.

Approach
Distillation operations at a plant or unit are evaluated in-depth during a visit lasting one to two weeks by two distillation consultants from Shell Global Solutions. The review is carried out jointly with the customer so that operational constraints are properly accounted for.

The focus during a distillation visit is on upgrading unit performance to gain potentially large benefits. Areas normally covered are options to increase the intake, particularly of distillation sections downstream of conversion units; crude distillation; high-vacuum units; yield improvement (such as higher recovery of gasoil in the crude distiller (CD) unit or high-vacuum gasoil in the high-vacuum unit); and energy-saving opportunities.

We make use of an extensive database, with typical unit performances, check lists and successful practices developed over the years, that allows a rapid focus on those issues with the highest improvement potential. We also carry out preparatory work using information received about the unit beforehand, such as a refinery block scheme, process flow schemes and test runs. The distillation service visit delivers a jointly agreed report with a list of potential improvement areas.

Experience and economics
Typically four to five distillation visits are made each year (including those made as part of Shell Global Solutions’ multidisciplinary hydrocarbon management reviews). It has been found that a clear and consistent view of the economic drivers and the product pool constraints is one of the key success factors in identifying significant benefits.
Benefits identified

- Improved kerosene yields of 400 t/d (3100 bbl/d) or 2.0% wt on crude (WOC) by optimising the naphtha–kerosene cut point and kerosene reboiler operation.
- Improved kerosene yield from Middle East crude of 2 to 2.5% WOC by modifying the top circulating reflux system of a CD unit and focusing attention on kerosene maximisation. Upgrading the top circulating reflux cooling capacity and minor tray modifications during the next shutdown offered a potential further WOC yield increase of 1 to 1.5%.
- Combining the benefits of a higher CD unit intake with improved heat recovery to give a higher CD unit furnace inlet temperature is an attractive revamp option that has been identified during distillation service visits, although simply improved heat recovery may not be justifiable on fuel savings alone. At two locations, optimising the crude preheat train resulted in an increase in the furnace inlet temperature (FIT) of the CD unit without any hardware changes (see Table 1).
- Improved gasoil recovery of 1 to 2% WOC on a CD unit by optimising the gasoil–long-residue cut point and stripping steam operation.
- Reducing the C5 content (where it is high) of the reformer feed has been found to result in decreased gas make and liquefied petroleum gas production.
- With the more stringent Reid vapour pressure specifications for the gasoline, stabiliser columns are becoming even more important in refinery operations. Operational changes in a stabiliser column or re-traying with high-capacity Shell trays has been found to reduce the C4 content in gasoline.

- In one refinery, the fluid catalytic cracking unit intake could be increased by 2% through optimising the overhead condensing capacity that offloaded the constraining wet-gas compressor.
- The quality and recovery of high-vacuum gasoil, as feedstock for a fluid catalytic cracking unit or hydrocracking unit (5% weight on intake), were improved after elements from Shell deep-flash high-vacuum technology were implemented, as recommended following a distillation service visit.

**Table 1: Heat recovery improvement in crude preheat trains.**

<table>
<thead>
<tr>
<th>Country</th>
<th>Increase FIT (°C)</th>
<th>Increase FIT (°F)</th>
<th>Throughput increase, %</th>
<th>Project type</th>
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<tbody>
<tr>
<td>Thailand</td>
<td>6</td>
<td>11</td>
<td>5</td>
<td>Operational changes</td>
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<tr>
<td>Dominican Republic</td>
<td>11</td>
<td>20</td>
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<td>Germany</td>
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<td>22</td>
<td>7</td>
<td>Mini-revamp</td>
</tr>
<tr>
<td>South Africa</td>
<td>29</td>
<td>52</td>
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Please contact Shell Global Solutions for further information

Shell Global Solutions International BV
Tel: +31 70 377 2470

Shell Global Solutions (Singapore) (Pte) Ltd
Tel: +65 6384 8803

Shell Global Solutions (US) Inc.
Tel: +1 281 544 8844

Email us at distillation@shell.com
Or visit our website at www.shellglobalsolutions.com

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