Shell Global Solutions

RESIDUE GASIFICATION

CONVERTING THE BOTTOM OF THE BARREL INTO VALUABLE PRODUCTS

AT A GLANCE

CUSTOMER DRIVER: Access to resources (unconventionals), changing feedstock slates (heavy and/or sour crudes), changing demand patterns (fuel specifications), sustainable operations (emissions)

SOLUTION: The SGP, which can convert a wide range of low-value heavy residues and asphaltenes into syngas

VALUE DELIVERED: Enhanced yield of high-value products, increased hydrogen production, ability to process a wide range of crude oils

PROOF POINT: Three plants (nine reactors) commissioned in the last 10 years

Traditionally, refinery residues have been sold as marine bunker fuel or used on-site as furnace fuel. However, with changing legislation, refineries are under pressure to reduce their emissions and the sulphur content of their products, and the market for fuel oil is shrinking. The Shell Gasification Process (SGP) can be combined with other upgrading and treating technologies to convert a wide range of low-value heavy residues and asphaltenes into synthesis gas (syngas) for:

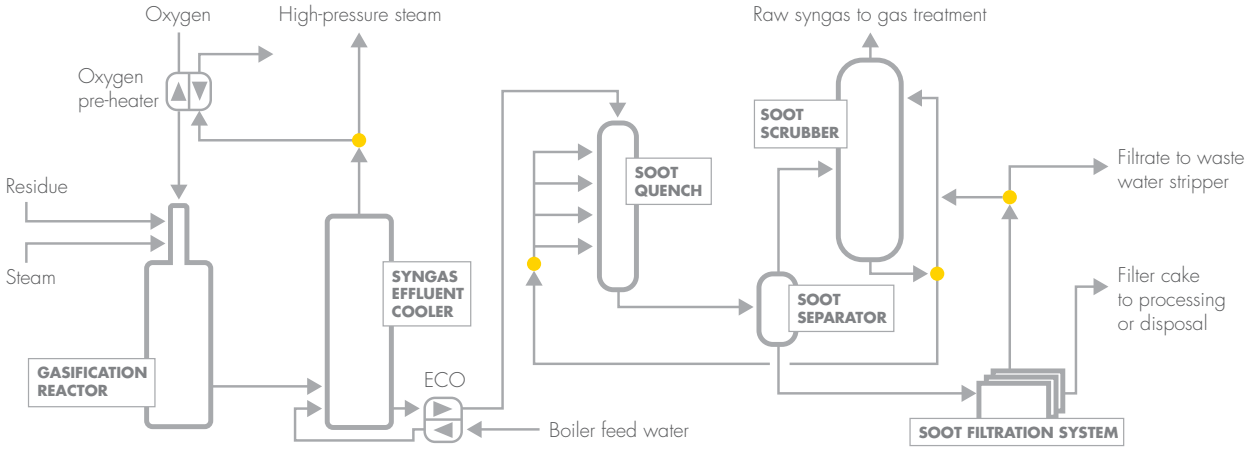
- integrated gasification combined-cycle (IGCC) power generation (with optional carbon dioxide capture);
- hydrogen via carbon monoxide shift; and
- other applications such as chemicals manufacturing.

Shell Global Solutions provides business, operational-support and project-execution services from design and engineering through to commissioning and start-up, experience transfer, master planning and training.

WHAT DIFFERENTIATES US

- Our gasification experience dates back to the 1950s; more than 170 Shell gasification reactors have been built.
- We continuously improve our technologies by incorporating lessons learned into our master designs.
- SGP units can process a wide range of feedstocks, including highly viscous, high-sulphur residues.
- Our designs offer performance advantages by helping to minimise oxygen and fresh water consumption, reduce soot formation and enhance syngas yield.
- Because Shell is both a gasifier owner and an operator, it has extensive experience in their start-up, operation and maintenance.

A TYPICAL SHELL GASIFICATION PROCESS SCHEME



PROCESS DESCRIPTION

The non-catalytic partial oxidation of hydrocarbons takes place in a refractory-lined reactor. The syngas is cooled in the syngas effluent cooler, which is directly connected to the reactor, and high-pressure saturated steam is produced. The low level of soot in the syngas is removed when it passes through a quench, a separator and a scrubber. An automated heat-up, start-up and shutdown system helps to provide reliable plant operation.

PERFORMANCE

Special burner and reactor designs help SGP technology to:

- convert high ash, sulphur and viscosity feeds;
- give high syngas yield – typically >2,600 Nm^3 syngas per tonne of feedstock;
- operate with low oxygen consumption and low soot formation (<1 mg/Nm^3 of soot in raw syngas); and
- provide enhanced thermal efficiency through the syngas cooling process (with high-pressure steam generation).

VALUE

The gasification process provides an intermediate product and is integrated into an existing (refinery) complex. This makes our gasification technology highly flexible and configurable to meet different needs. It can help in:

- improving product quality while reducing plant emissions;
- producing hydrogen for processing today's clean fuels;
- adapting processing facilities as demand for fuel oil diminishes;
- reducing demand for natural gas;
- converting low-value products into high-value products;
- using bottom-of-the-barrel oil for power; and
- implementing an enhanced oil recovery project using carbon dioxide.

HAVE YOU CONSIDERED HOW YOU CAN

- improve product quality while simultaneously reducing plant emissions?
- produce sufficient hydrogen to increase the yield of clean fuels that meet ever more stringent requirements?
- adapt your processing facilities as demand for fuel oil diminishes?

CASE STUDIES

MEETING REFINERY ENVIRONMENTAL AND PRODUCT QUALITY NEEDS

At the Shell Pernis refinery, the Netherlands, a gasification unit was integrated with a new hydrocracking unit and a cogeneration plant to help meet stringent environmental and product-quality requirements. A revamped deep thermal cracker produces 1,650 t/d of high-sulphur, heavy residue as gasification feed. The syngas produced is used in making 285 t/d of hydrogen for the hydrocracker and as a clean fuel for power generation in a 117-MWe IGCC plant.

PRODUCING SYNTHETIC CRUDE FROM OIL SANDS

Bitumen extracted by Nexen Inc. from the Athabasca oil sands, Canada, is converted using the OrCrude™ process to partially upgraded product and a heavy asphaltene by-product. The heavy asphaltene feeds a 3,800-t/d SGP unit. The gasifiers generate hydrogen for a distillate-hydrocracking unit, which upgrades the product further into premium-quality synthetic crude. Excess syngas is used to generate steam and power for bitumen extraction.

For further information, please visit our website at www.shell.com/globalsolutions