EST™
Eni Slurry Technology

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CLG
Chevron Lummus Global

OVERVIEW

EST or Eni Slurry Technology is a near complete conversion slurry hydrocracking process that represents the refining industry's hugely successful and efficient way of converting atmospheric and vacuum residue, heavy and extra-heavy oils like bitumen from oil sands, solvent deasphalting bottoms, visbroken tars, FCC slurry oil, unconverted vacuum gasoil (VGO) from hydrocracking, pyrolysis oil from steam crackers, and other heavy hydrocarbons to higher value distillate products. The process features high yields and high removal of contaminants in a safe, reliable, easy-to-operate plant.

The products from an EST unit can be fed to Chevron Lummus Global's (CLG) ISOTREATING™ or ISOCRACKING® reactor or conventional refining hydroprocessing unit for upgrading to higher value finished products like jet fuel or diesel or used as feedstocks for petrochemical processes to produce base chemicals like ethylene, propylene, aromatics, etc. The EST products can also be blended with additional bitumen to produce syncrude for upstream applications.

EST research and development efforts began in the early 1990s. After an intensive development period carried out at a laboratory level, a pilot plant was built and operated at Eni's San Donato Milanese facilities to demonstrate the technical feasibility of the process. Subsequently, Eni built a commercial-demonstration plant (CDP) of 1,200 BPD capacity at its Taranto refinery.
The demonstration plant operated successfully with a wide range of feeds, including conventional crude vacuum residues,
bitumen from oil sands, extra heavy oils and visbroken tars.

In 2013, the first EST commercial unit was built in Eni's Sannazzaro refinery. Since then, Eni has licensed EST to various refiners globally, with the most recent in 2022 to Yulong Petrochemicals under the Chevron Lummus Global Alliance.

TECHNICAL ADVANTAGES

Process Features	Process Benefits
Simple Process Flow Scheme	A simple flow scheme with the ability to add parallel reactors to increase capacity Lower capital costs for low-capacity single reactor applications or multi reactors world scale applications, unlike other platforms Simple catalyst recycle from the fractionation section
Slurry Bubble Column Reactor	Simple slurry bubble column reactors without any complex internals or pumps, perfectly homogeneous for isothermal reactor operations
Most Feed Flexibility	Ability to process various difficult resid feedstocks containing high impurities (metals, nitrogen, CCR, sulfur, etc.)
Advanced Controls Monitoring & Surveillance System	Safe, reliable unit operation and smooth and fast unit start-up
High Conversion Technology	Maximizes bottom of the barrel upgrading to valuable distillates (97% + conversion of resid feed)
Simple Catalyst Addition	A straightforward system to make up the nanocatalyst precursors or ISOSLURRY™ catalyst pumped from an atmospheric insulated tank and a small volumetric pump
Nano-sized Dispersed Catalyst Precursors or Micron Sized Sulfided Moly Catalyst	A very active, nano-dispersed, non-aging, unsupported catalyst, which prevents coke formation and promotes upgrading reactions (sulfur, nitrogen, metals removal and CCR reduction) Alternately, CLG developed a micron-sized unsupported NiMo ISOSLURRY™ catalyst that absorbs coke and coke precursors in the pore of the catalyst, keeping the reactor clean

PROCESS DESCRIPTION & BLOCK FLOW DIAGRAM

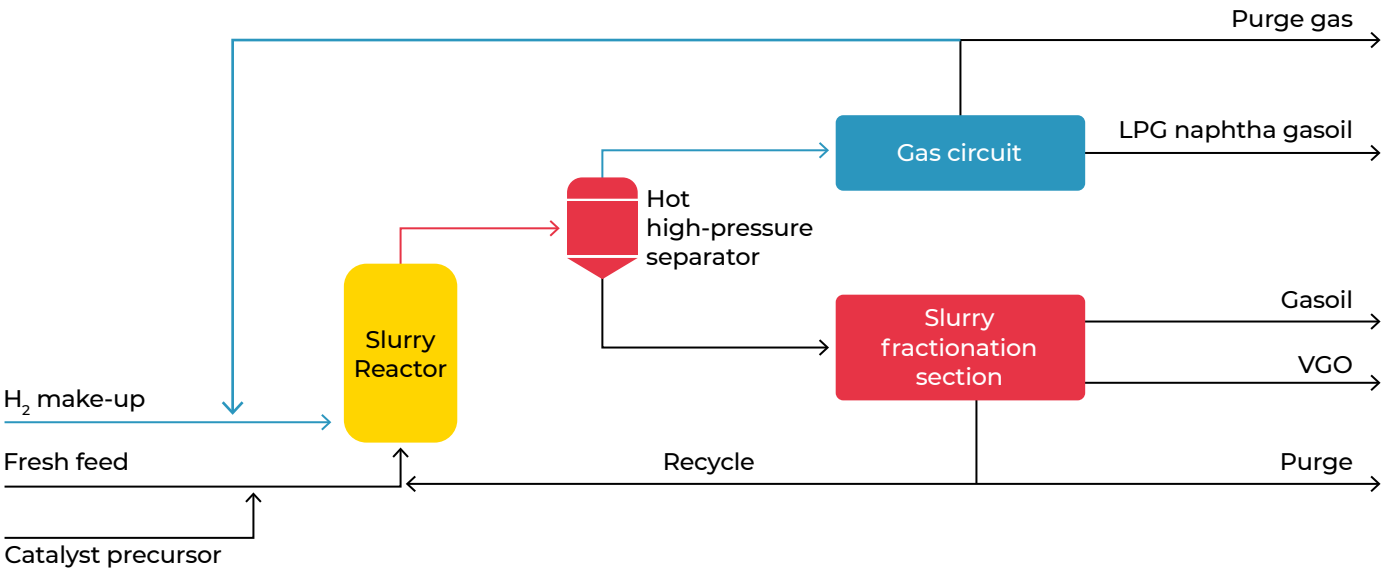
The feedstock, preheated and mixed with the vacuum column recycle that contains the active catalyst, is fed to the slurry bubble-column reactors; the hydrogen-rich recycle gas is separately fed. In the reactors, the feedstock is partially converted into light gases, naphtha, middle distillates and VGO. The effluent from the slurry reactors is sent to the hot, high-pressure separator (HHPS).

Recycle gas loop vapors from the HHPSs are cooled and sent to the cold high-pressure separator (CHPS). The light hydrocarbon phase from the CHPS is sent to the light products fractionation section. The gas from the CHPS is recycled back to the reactors, except for a small stream that is removed to maintain constant hydrogen partial pressure. A stream of fresh hydrogen is made up to balance.

Slurry fractionation liquid from the HHPS is sent to the hot low-pressure separator (HLPS).

The liquid is fed to a pre-flash column and a vacuum tower to separate the distillates (AGO, LVGO and VGO streams). The bottom stream from the vacuum column, rich in asphaltenes and catalyst, is recycled to the slurry reaction section, while a minimum amount of it is drawn off and delivered to the battery limits. This is done to avoid metals buildup in the process since distillate streams do not contain metals. The unconverted stream can be used in different ways, such as fuel for cement factories or feedstock for gasification and coking plants.

Moreover, it is possible to recover the metals, including molybdenum, from the ashes for the gasifier feed option. Moreover, it is possible to recover the metals, including molybdenum, from the ashes for the gasifier feed option. The slurry reactors are almost isothermal axially and radially and operate in the range of 425°C–435°C and at a pressure of 150 bara–160 bara.



CLG-ENI ALLIANCE

CLG and Eni formed an alliance to jointly market the EST technology in September 2021.

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