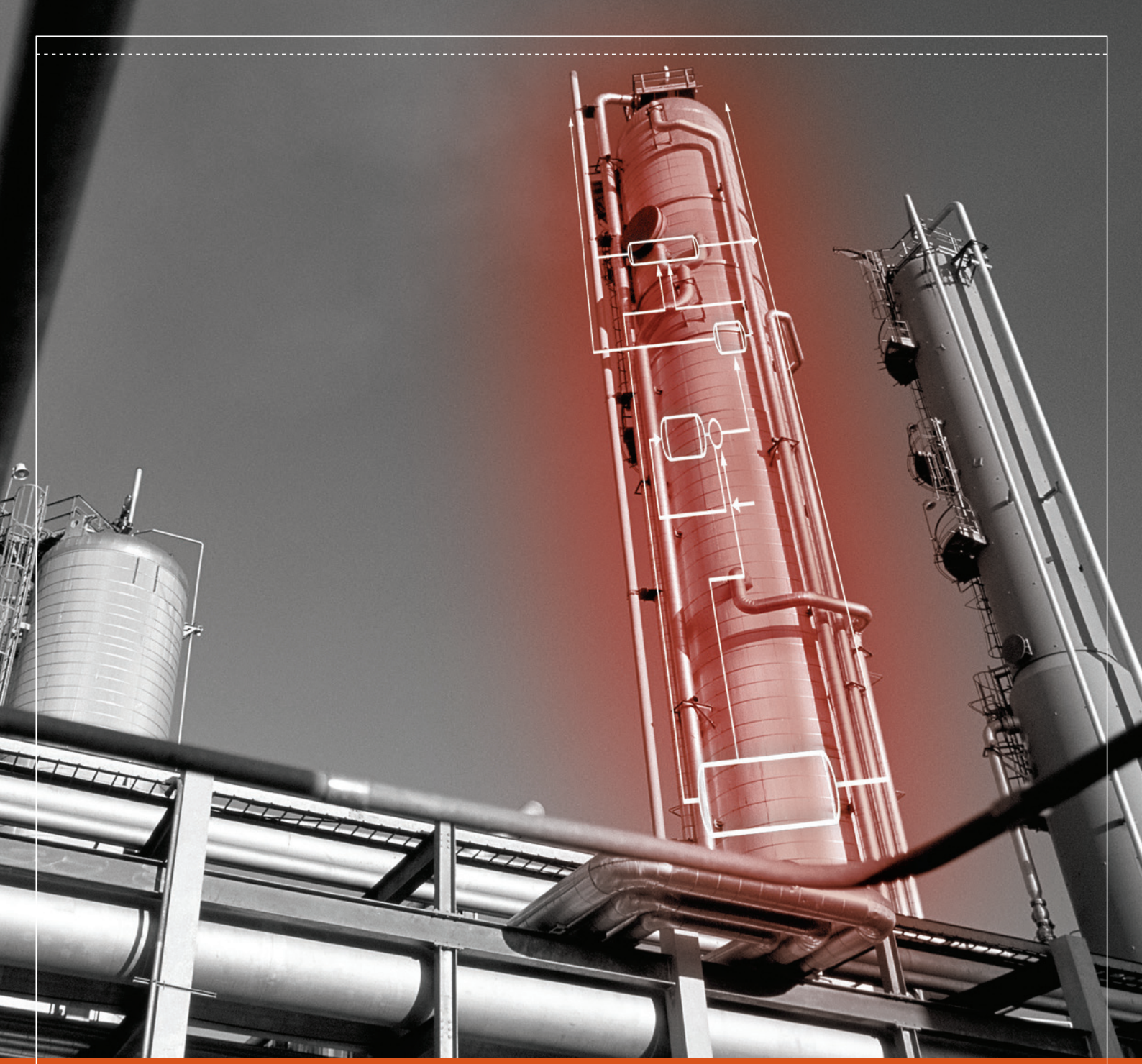

GT-BenZap®

Technology Licensing

Cost-Effective Benzene Management

GT Technology

Engineered to Innovate®

GT-BenZap®: Cost-Effective Benzene Management

GTC Technology's process know-how can meet refiners' needs by providing a variety of cost-effective solutions, ranging from aromatics extraction to catalytic hydrogenation for benzene management in gasoline-bound streams. GT-BenZap is a benzene saturation process that is designed as a low-cost alternative for refineries limited by economies of scale, or for units located in remote areas away from benzene consumers, to enable them to comply with the EPA's regulations. When implementing GT-BenZap, GTC provides custom integration with the refiner's existing units for effective benzene management.

GTC Technology's GT-BenZap allows refineries to implement a low-cost benzene saturation process to ensure compliance with the EPA regulations under Control of Hazardous Air Pollutants from Mobile Sources (MSAT2).

Process Overview

The GT-BenZap process features a reliable traditional design paired with a proven nickel-based catalyst.

GT-BenZap consists of hydrotreating a narrow-cut C_6 fraction, which is separated from the full range reformate to saturate the benzene component into cyclohexane. The reformate is first fed to a reformate splitter where the C_6 heartcut is separated as a side draw fraction, while the C_7^+ cut and the C_5^- light fraction are removed as bottom and top products of the column.

The C_6 olefins present in the C_6 cut are also hydrogenated to paraffins, while the C_5^- olefins removed at the top of the splitter are not, preserving the octane.

The hydrogenated C_6 fraction from the reactor outlet is sent to a stabilizer column where the remaining hydrogen and lights are removed overhead. The C_5^- cut, produced off the splitter overhead, is recombined with the hydrogenated C_6 cut within the GT-BenZap process in a unique manner that reduces energy consumption and capital equipment cost. The light reformate is mixed with the C_7^+ cut from the splitter column and together form the full range reformate, which is now low in benzene content. Energy consumption ranges from 900-1,000 btu/lb feed. Hydrogen consumption is nominal, approximately 10 percent above stoichiometric. Refinery H_2 availability will determine system design requirements. GTC also offers a modular construction option and the possibility of reusing existing equipment or a conventional splitter design.

Advantages

GT-BenZap is more economical than platinum-based benzene saturation systems and can be adapted to retrofit existing refinery units. In addition to being competitively priced and yielding lower operating costs, the process offers refiners the following benefits:

- Ability to reduce benzene in the reformate stream by over 99.9 percent
- Simple and reliable technology that uses an isolated hydrogenation reactor
- World-class catalyst utilized in the process
- Minimized impact to hydrogen balance and octane loss
- Reliable method to meet the EPA's Control of Hazardous Air Pollutants from Mobile Sources (MSAT2) regulations

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Economic Analysis

Basis	15,000 BPSD C_6 Cut Stream
Erected cost	$12MM (ISBL, 2008 U.S. Gulf Coast Basis)

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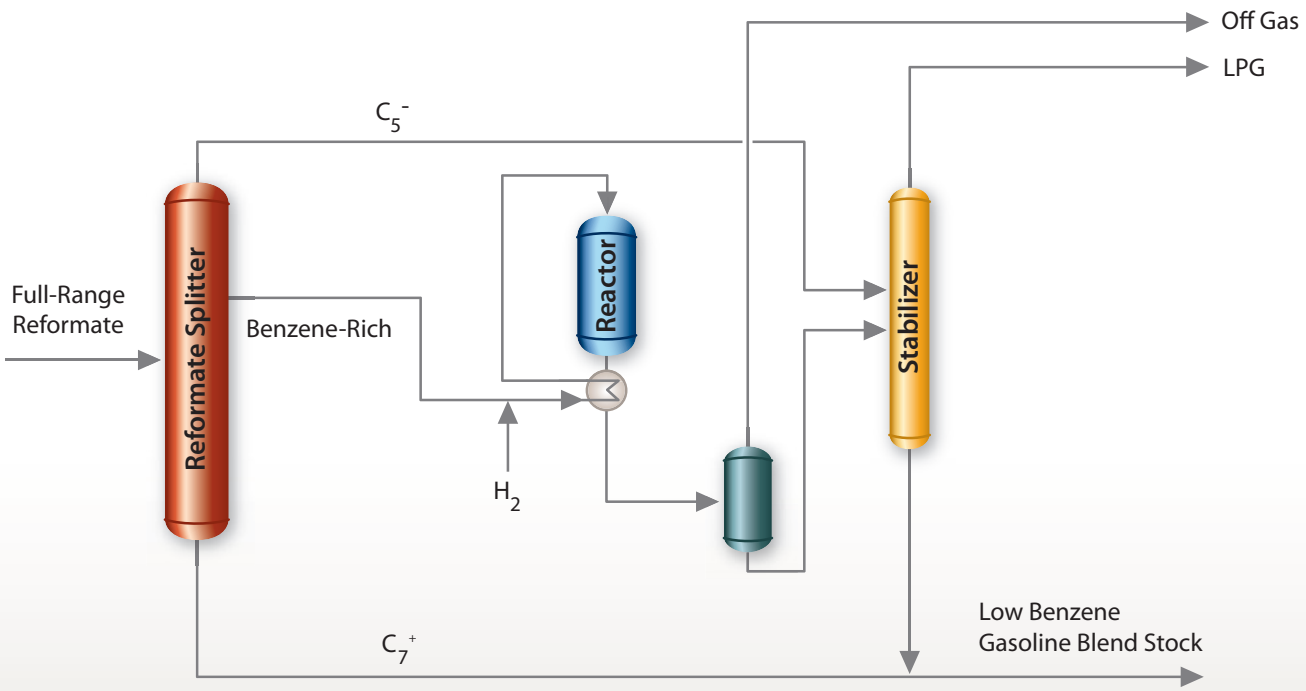
To learn more about GTC Technology's leading-edge technology solutions and the many ways we can help improve your operations and profitability, call us today at **+1-281-597-4800,** e-mail us at **inquiry@gtctech.com** or visit our Web site at **http://www.gtctech.com.**

GT-BenZap®



A narrow-cut C_6 fraction is first separated from the full-range reformate and then hydrogenerated to saturate benzene and contained olefins. The reactor effluent is sent to a stabilizer to remove light components. There is an option to process C_5^- from the reformate splitter in the same stabilizer. The stabilizer bottom stream is combined with C_7^+ from the splitter bottom and sent to the gasoline pool as low-benzene blend stock.

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GTC Technology is a global licensor of process technologies and mass transfer solutions with the mission of creating value for our clients. Refining, petrochemical and chemical companies around the world rely on GTC's advanced processes to optimize production capacity and efficiency. With insightful industry expertise, research capabilities and innovative thinking, GTC solves complex processing problems and has earned a reputation of excellence in designing and delivering high-quality, strategic solutions for clients worldwide. We're engineered to innovate.

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