

**Abstract Title: BAPCO Hydrocracking Unit : A Decade of Success**

**Author: Velmurugan Venkatesan, BAPCO**

The Bahrain Petroleum Company (Bapco) is 100% owned by the Government of the Kingdom of Bahrain and operates the Bahrain Refinery. The refinery, which started up in 1936 with a capacity of just 10 MBPD and was the first in the Arabian Gulf, is geared towards maximizing middle distillates. Over the last 82 years the facilities have been regularly revamped and new units have been added. Today it is a world-scale, complex refinery with a capacity of 265 MBPD and incorporating many of the latest process technologies, including hydrocracking.

In 2007, Bapco commissioned its Low Sulphur Diesel Production (LSDP) Complex, the heart of which is a 60 MBPD VGO Hydrocracking unit (1HCU). It is a 2-stage unit with recycle, licensed by Chevron Lummus Global (CLG). Since then, 1HCU has been a success story due to Bapco's unwavering commitment to identify opportunities for innovation and improvement in design, operation and performance. Success has been built on in-house knowledge and expertise and close collaboration with catalyst vendors and the process licensor.

Even before the 1HCU design had been finished, Bapco saw the opportunity for a Group 3 lube base oil unit (LBOU), which could be fully integrated with the hydrocracker to increase refinery competitiveness and profitability. The LSDP Complex was successfully commissioned in 2007, followed by state-of-the-art LBOU in 2011.

In early 2010, in a challenge to conventional thinking, we implemented an innovative change to the 1HCU process configuration, by routing fresh HVGO feed directly to the second stage reactor, resulting in a novel approach, and the only unit in the world with this configuration and a downstream LBOU. The benefits of the unique configuration were confirmed by the licensor, and resulted in better quality products and overall better performance.

In our pursuit for further improvement, we also recognized the need to increase the 1HCU catalyst cycle length from 2 to 3 years. This was achieved in collaboration with the catalyst vendors through extensive pilot plant testing and catalyst development to establish the right catalyst system for Bapco. The overall benefit has been one less catalyst changeout shutdown in the 6 year turnaround and inspection (T&I) cycle, delivering significant savings.

Over the last 10 years, we have relentlessly maintained our efforts to improve yields and product qualities through unit optimization and working with catalyst vendors to get better catalysts. The most recent changes to the 1HCU catalyst system have led to an increase in middle distillate yield while meeting the key properties of the LBOU feedstock. This move also created operational flexibility and helped improve overall refinery economics.

The main aim of our presentation is to share our experience over the last decade in maximizing the benefit of our main profit center viz. 1HCU. We show how improvements in



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process efficiency are driven by process engineering expertise, knowledge and understanding and that in-house process engineering expertise and close collaboration with vendors and licensors are the foundation of innovation and value creation.