

Complete refurbishment and upgrade of 40-year-old fertilizer plant equipment

Many Mexican downstream plants ceased operation in the 1990s because of feedstock supply limitations and poor transport capacity. The Coatzacoalcos site was one of them. It lay dormant for over 15 years until Pemex bought it in 2014—and Baker Hughes, a GE company (BHGE), was asked to help bring it back on line.

40

year-old equipment refurbished
to modern standards

13

months saved by
refurbishment approach

67%

cost vs. purchasing new units

Challenge

This complex fertilizer plant rehabilitation covered the core machinery plus all auxiliaries and process items. Much of the machinery was installed 40 years ago. It had now been dormant for 15 years, and there were signs of internal corrosion and deterioration of parts.

Many design and technological advances have occurred since the original equipment was built, so we needed to reconcile differences between the various old design standards and those used today.

We worked closely with Pemex and its construction company, Avanzia, to assess the equipment condition and evaluate the feasibility of refurbishment versus replacement.

Solution

After taking a detailed inventory of all the equipment and running a cost analysis, we were confident that the equipment could be restored. Pemex approved our plan, and we started moving machines to a local partner's nearby workshop for engineering assessment of parts and machines. Every single component was disassembled and inspected. Core equipment was then moved to our primary facilities in Italy for restoration—steam turbines and compressors in Florence, main process valves in Bari.

Many of the machines had been discontinued from production, and some parts couldn't be repaired—so we re-created them. This required continuous collaboration between the site repair teams and our engineering and design departments in Florence, Bari, and Massa. Avanzia's project management capabilities were instrumental, and the quality and commitment of the local workforce were outstanding. It was an exceptional team across the board.

“Bringing this plant back online will significantly increase Mexico’s fertilizer capacity, reduce transport costs for Mexican farmers and allow us to benefit from lower gas prices. BHGE’s expertise and service solutions were key to reducing the project time; doing so in such a complex environment is a notable achievement.”

Edgar Torres Garrido, Executive Advisor to Pemex CEO

Reverse-engineering and retrofitting were key. Most of the units were Nuovo Pignone, a well-known BHGE heritage brand—so most of what we needed was in our design archives. For machines from unrelated manufacturers, we either repaired them or used 3D drawings and laser scanning techniques to re-create them.

Replicated parts were improved with new materials and design techniques to make them lighter, stronger, and more durable. For example, the **2BCL and 4MCL compressors** were optimized

with innovative CFD technologies, lube oil consoles benefitted from API 614 experience and new materials, and steam turbines were optimized with new controls and performance-monitoring capabilities. We improved rotor dynamics according to modern calculation methods, and injected new instrumentation to improve safety and reliability. The upgraded trains achieved Safety Integrity Level 2 (SIL 2), a concept absent from the original plant design.

Our contract scope widened as the project progressed, and we identified more ways to reduce complexity and increase productivity. We replaced the several balance-of-plant systems with new solutions compliant with the latest TRS, SIL, and IEC standards. The a new **Mark™ Vle control system** automates startup and operation of the compression train, enabling real-time monitoring and optimization according to process conditions.

Results

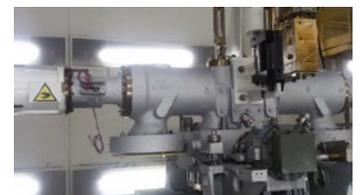
We're very pleased to report that the plant has been transformed to meet today's performance standards—at 33% lower cost than if Pemex had purchased all new units. With modernized turbocompression trains and auxiliary systems, it can now efficiently produce just over 1 million tons of urea every year—that's 75% of Mexico's entire annual demand.

In addition to the employment and economic benefits to the country's oil and gas sector, the rejuvenated plant is empowering the local agriculture industry by significantly reducing dependence on more expensive imported fertilizers. This boost to local farming viability will also ease Mexico's reliance on food imports—which currently account for an alarming 45% share of basic staples.

The project is in its final stages, and Coatzacoalcos is expected to be in production by the end of 2017. By executing our refurbishment strategy, BHGE's initial 30-month schedule was cut down to 20. Considering the lower project costs and earlier production start date, that translates into significant extra value for Pemex.



2MCL centrifugal compressor before and after



HG-type steam turbine before and after

bhge.com

Copyright 2017 Baker Hughes, a GE company, LLC ("BHGE"). All rights reserved. The information contained in this document is company confidential and proprietary property of BHGE and its affiliates. It is to be used only for the benefit of BHGE and may not be distributed, transmitted, reproduced, altered, or used for any purpose without the express written consent of BHGE.

Baker Hughes reserves the right to make changes in specifications and features shown herein, or discontinue the product described at any time without notice or obligation. Contact your BHGE representative for the most current information. The Baker Hughes logo and Mark Vle are trademarks of Baker Hughes, a GE company, LLC. GE and the GE Monogram are trademarks of the General Electric Company.

BHGE_Case_Avanzia-Pemex-101217