

# **Title: Enhanced Oil Recovery project (EOR)**

**Date:** 2006-2008, 2013-2014

**Scope:** From conceptual stage to Detail Engineering

**Location:** Venezuela

PETROCEDEÑO production facilities are located in Venezuela within the Orinoco Belt. Production started in 2001 reaching a maximum of 202,500 BPD of Extra Heavy Oil (XHO) of 8.5 °API. This XHO is diluted to decrease its viscosity and sent to an Upgrader located in the Jose region. There, the diluted crude oil is upgraded and synthetic light crude is produced and exported. The diluent, is continuously sent back to the existing Main Station, for recycling.

## **EXECUTIVE SUMMARY**

The objective of this Project was to conceptualize and develop the detail engineering for the required surface facilities, using proven technologies to test the reservoir behavior under two hot production mechanisms: SAGD (Steam Assisted Gravity Drain) and HASD (Horizontal Alternating Steam Drive). The aim was to explore the best scheme to increase oil recovery, on a large scale, compared to using cold production.

Initially a production capacity of 20,000 BPD was considered during Conceptual and FEED engineering, but due to the high investment involved, the design capacity was revised and adjusted to 4,000 BPD.

The field facilities for 20,000 BPD were comprised of three SAGD clusters with 18 well pairs and one HASD cluster with 7 wells. The Clusters' design included surface facilities necessary for steam injection and recovery of EHO production. Full emulsion treatment to be performed at the new substation in order to export the diluted crude to the existing facilities. All major processing equipment components were located at the Substation with some production testing and group separation facilities located at the clusters.

For the revised concept at 4,000 BPD, two well-pads and a Process Area were contemplated. All major processing equipment components are located in the Process Area with wellheads located at the clusters. The two clusters included surface facilities necessary for steam injection and recovery of multiphase production. One with three SAGD well pairs, three HASD wells (two alternating injection/production and one permanent production) and two horizontal production Steam Drive (SD) wells. The second cluster consists of 3 steam vertical injector wells for SD mechanism. PCP pumps and Gas lift were incorporated in some of the wells.

Vepica performed the conceptual engineering and FEED for both concepts and the detailed design for the 4,000 BPD facilities

### **CHALLENGE**

To support the Client to reduce required CAPEX for the 20,000 BPD crude production and testing facilities.

### **VEPICA SOLUTION**

After the Client's decision to reduce the extra heavy oil crude production capacity from 20,000 BPD to 4,000 BPD, Vepica contributed with its wide experience and through value engineering to optimize the processing facilities. The major contribution was to replace the use of formation water for the use of water from deep water wells as the source for steam generation. This decision reduced the required water treatment to produce the expected quality for steam generation. The formation water was sent to existing facilities for treatment and disposal.