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## Benguela-Belize Project Overview

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### Abstract

The Benguela-Belize Project, an oil and gas production development located in the northern part of Block 14, offshore Angola, West Africa, is the first application of compliant piled tower (CPT) technology for a drilling and production platform outside the Gulf of Mexico. The drilling and production platform (DPP) serves as a production hub for the Benguela, Belize, Lobito and Tomboco (BBLT) oil fields and is located in 390 m (1,280 feet) of water 70 km (45 miles) offshore Cabinda, Angola. Cabinda Gulf Oil Company (CABGOC), a wholly owned subsidiary of Chevron Corporation, is the block operator on behalf of the partner group consisting of CABGOC, Sonangol P&P, TOTAL, ENI and GALP.

This paper presents the alternative analysis process, challenges and lessons learned in selecting the optimum development concept where a wide range of feasible technical solutions were applicable. Key factors included: 300-600 m (1,000 to 2,000-foot) water depth, surface or subsea wellheads could be used, shallow reservoir depths, proximity of existing infrastructure for oil storage and export and additional prospects identified within subsea tieback distance to the production hub. Other factors that influenced the development alternatives included: low reservoir pressure requiring 1 to 1 water injection to withdrawal ratio; shallow reservoir depths spread over a large area; crude oil gravity variations requiring the assessment of processing 24° API and 38° API crude oils; crude oil storage and export options via floating systems or via pipelines and produced gas management.

A deliberate strategy to use existing oil and gas facilities in both Block 14 and Block 0 for the BBLT hub production export was pursued to minimize the overall capital invested and future operating costs. The final development solution, the compliant piled tower, was an outcome of the development concept selection process and provided the opportunity to apply innovative technology to West Africa.

### Introduction

Since the mid-1990s the deepwater region offshore Angola has proved to be a world-class oil province. Exploration success has been followed rapidly by the development of a number of new fields. The growth in production from the deepwater is forecast to take Angola's production over 1.5 million barrels of oil per day (MMBOPD) by 2006 and 2.5MMBOPD by 2010.

Deepwater Block 14 is located offshore from the Cabinda Province west of the Chevron operated Block 0 (Figure 1). Block 14 is 4,025 km<sup>2</sup> (1,554 mi<sup>2</sup>) in size and has water depths ranging from 200 m (660 ft) in the northeast to 2,000 m (6,600 ft) in the Congo Canyon that traverses the southern portion of the Block. So far, Chevron and the Block 14 Contractor Group (Sonangol P&P, TOTAL, ENI and GALP) have made ten discoveries in the highly prospective Block 14 on behalf of the Block Concessionaire, Sonangol E&P, including: Kuito (1997), Benguela and Belize (1998), and Tomboco and Lobito (2000)(Figure 2).

The oil fields discovered by wells 14-9X (Benguela), 14-10X (Belize), Lobito-1A (Lobito) and Tomboco-1 (Tomboco) have been ring-fenced into the single Benguela-Belize-Lobito-Tomboco (BBLT) Development Area. In 2003, the BBLT Development Plan was approved by the Block 14 Concessionaire and the Angolan Ministry of Petroleum. This paper will provide an overview of the BBLT Development Plan, including the development concept selection process and the benefits of leveraging existing infrastructure to facilitate the construction of Angola's next deepwater production hub.

### BBLT Resource Base

Six main oil pools make up the BBLT complex with oil in place approaching 1.5 billion barrels (Figure 3). The reservoirs are composed of high quality turbidite sands deposited in a middle bathyal slope valley/incised canyon environment. Reservoir sands form vertically stacked and nested channel complexes that both erode and aggrade pre-existing sediments. The turbidite complexes are typically 500-2000 m (1,600-6,660 ft) wide, 10-60 m (30-200 ft) thick, composed of intercutting sand-rich turbidite channels, shale-rich mudflows, debris flows and slumps. Regionally, the channel systems lie beneath highstand shales, providing high quality seals both laterally and vertically. Reservoir properties are excellent (25 to 32 % porosity, 1 to 6 Darcy average permeability with 24°-38° API gravity oil), and channel-axis sands are highly prolific with average individual Drill Stem Tests (DST) of approximately 10,000 STBOPD.