Lula Field Brazil: A Unique Giant Carbonate Discovery in the South Atlantic

James Faroppa¹ and Rod Sloan¹

¹C&C Reservoirs, Maidenhead, Berkshire, United Kingdom.

ABSTRACT

The Lula Field is located in the Santos Basin, offshore Brazil, at a water depth of >2000 m. It was discovered in 2006 and brought onstream in 2010. At the time of discovery, it was a new play type in the South Atlantic and still has few global analogues. The field has an EUR of 6.5 BBO with the total potential pre-salt resources in the deep-water Santos basin being estimated at more than 30 BBO. The geological success rate in the Pre-salt to date is around 46%. The Lula Field is situated on the Outer High of the Santos Basin, which comprises a 12,000 km² four-way closure at the base Aptian salt level. This regional basement structure comprises a segmented series of tilted rift fault blocks, which were inverted, uplifted and eroded during the late Barremian. A thick evaporite salt seal overlies the Aptian carbonate reservoir. The 400 m-thick lower Aptian Barra Velha Formation, which contains the majority of field reserves, consists of shallow-water lacustrine microbialite or abiotic limestones. The Itapema Formation consists of coquina (bioclastic debris) limestones and is a secondary reservoir. The Barra Velha reservoir has layer-cake architecture, but is highly heterogeneous due to depositional and diagenetic complexities. Typical porosity and permeability values are 8-20% and 20-500 mD, but permeabilities up to 5 D are observed locally. The reservoir contains 28 °API oil with a high GOR. Reservoir energy is provided by solution-gas and rock and fluid expansion drive. A phased development program began with two extended well tests in 2009, undertaken to better understand reservoir behaviour before committing to a final production strategy and facilities. Subsequently, production pilot tests were implemented to evaluate the performance of different recovery methods. Lula is being developed in a hub-and-spoke configuration, with clusters of subsea wells tied back to FPSOs capable of handling both produced hydrocarbons and injection fluids. Rather than venting or sequestering the produced CO2, an early decision was made to maintain reservoir pressure and enhance recovery by implementing CO2-WAG injection concurrent with development drilling. Already the Pre-salt production accounts for 47% of Brazil's oil production. There were 75 wells in production in April 2017. The 10 top Brazilian producing oil wells in April 2017 were all producing from the Pre-salt, with the average productivity around 30,000 BOPD.