Case Study - 11

Increased oil, reduced water and reduced CO_2 production with AICV® well compared to conventional AICD wells

An operator in South America started the development of a remote green oilfield in 2018 with horizontal wells. Due to the presence of a strong water drive mechanism, the initial well reached unacceptable water production levels, negatively impacting oil production and CO_2 footprint; driving the operator to evaluate and install advanced completion technologies to control water production and improve reservoir drainage.

Challenges and Objectives

In 2018, the first horizontal well of the field was drilled in the flank of the reservoir structure and completed with stand-alone screens (SAS), quickly demonstrating the presence of a strong aquifer, and showing early water breakthrough. Hence, the operator decided to switch their reservoir management strategy and opted for advanced completions with screens and AICDs to delay and control water production in the field. Even though initial results were positive, and a considerable improvement compared to SAS completions has been observed, such outcomes have been highly dependent on the structural position of the wells. Trialed AICD technologies have proven to delay water breakthrough but due to its operating principles, they cannot effectively control zones with higher water saturation.

Solutions

After a detailed simulation study, comparing the performance of an existing AICD-RCP completion versus an AICV® completion, pre-drilling modelling indicated potential oil increase of 14% and 2.2 million barrels of water reduction in 400 days of production. The results demonstrate the AICVs ability to efficiently drain the reservoir by autonomously shutting off zones with 100% water while applying higher drawdown to zones with higher oil saturation, resulting in higher PI's, as AICV® valves pose less restriction to such zones. A 1,000-meter lateral was drilled and completed in the flank of the reservoir with 40 AICV® quad joints (160 valves) in 20 compartments.

Results

The results involve the comparison of 4 wells placed in the flank of the reservoir structure: (A) AICV®, (B) AICD-RCP, (C) SAS and (D) AICD-RCP, all with similar positions relative to the oil-water contact. Wells A and D have longer horizontal sections (>1,000 m) compared to Wells B and C (>340 m). Indicators like oil cut clearly show that the AICV® completion has demonstrated better water control compared to its analogous RCP completion as stabilization has been noticed at higher oil cut/WOR. A recent pump frequency increase in the AICV® well showed its ability to control zones with high water saturation while allowing production from zones with better oil saturation, as oil cut increased 15% to 20%.

LOCATION
South America

OPERATOR
International E&P

DEPLOYMENT
Onshore

RESERVOIR
Unconsolidated sandstone reservoir

COMPLETION
4-1/2" AICV® with premium screens and swellpackers

Results

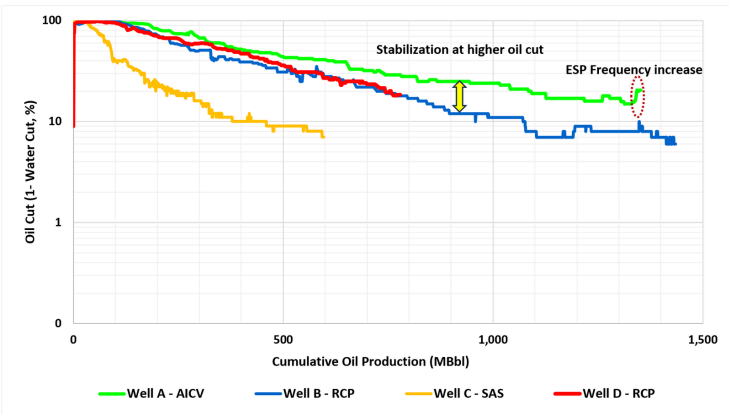
200,000 Bbl
additional increased oil production vs. AICD

3,500,000 Bbl
additional reduction of water production vs. AICD

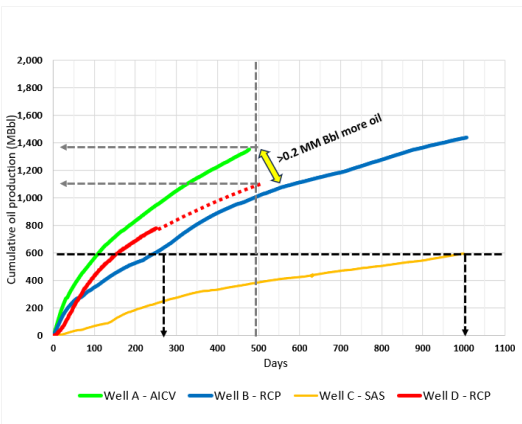
1,000,000 Ton
less CO_2 / year vs. AICD

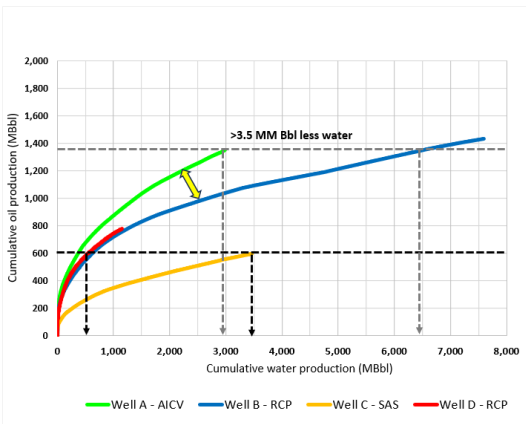
inflow control

Cumulative oil production over time and cumulative oil production versus cumulative water production results indicate that there is a considerable difference between SAS completions and AICD/AICV® completions. It can also be observed that the AICV® completion has outperformed its analogous RCP completion and is producing more than 0.2 MM Bbl of oil more while producing 3.5 MM Bbl of water less in 500 days of production data (reducing emissions by >1 MM ton CO_2/year).



Cumulative oil production and WOR (water oil ratio) comparisons by well type





AICV® vs. AICD-RCP vs. SAS performance over time