

An Analysis of the Use of Hydraulic Jet Pumps, Progressive Cavity Pumps and Gas Lift as Suitable Artificial Lift Methods for Heavy Oil Production in East Soldado Reservoirs, Offshore the Southwest Coast of Trinidad

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Abstract: Artificial lift refers to the use of artificial means to increase the flow of oil from a production well when there is insufficient pressure in the reservoir to lift the oil to surface, or in flowing wells to obtain a desired production rate. Generally, this is achieved by the use of a mechanical pump inside the well or by decreasing the weight of the oil column by injecting gas some distance down the well. On platform X in the Soldado field offshore the Southwest coast of Trinidad, gas-lift and to a lesser extent, progressive cavity pumps (PCP), are installed in wells to sustain the desired oil production targets. More recently, hydraulic jet pumps have been installed. However, a performance analysis of these lift systems has never been conducted to determine which one is most suitable for this reservoir. In this study, the software PipeSim was used to develop models for the currently installed gas lift and PCP configurations and then optimised to determine the best oil lifting capabilities for these two systems. Similar models were developed for the hydraulic jet pumping system using the SNAPTm software. Data from a pilot well indicate that the optimised installations for gas lift, PCP, and hydraulic jet pumps when sequentially applied are capable of lifting 90, 325, and 450 barrels of fluid per day (bfpd), respectively. These results indicate that hydraulic jet pumps are capable of lifting 40 % more fluids than PCP and 400 % more than gas lift. A lift score analysis between PCP pumps and hydraulic jet pumps was then conducted by comparing lifting potential, installation cost and time, rig vs. non-rig intervention for the installation; and ease of operation and optimisation. The results from this analysis indicate that the average lift score for hydraulic jet pumps was 4.5 and 2.5 for PCP pumps. These results indicate that in addition to having the highest lifting capability, hydraulic jet pumps are cheaper and easier to install, operate and maintain. It is also a more cost-effective oil lift system compared to PCP pumps. This lift score can also be used as a guide to effectively optimise artificial lift systems for other oil wells from this field.

Keywords: Artificial lift; jet pumps; performance evaluation; increase flow; oil well; Trinidad