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Changing mindsets: How O&G ALS technology concepts enable worldwide food security and a greener future by improving boron production efficiency in a mining application project developed in California

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Changing mindsets: How O&G ALS technology concepts enable worldwide food security and a greener future by improving boron production efficiency in a mining application project developed in California

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Abstract

A common mindset considers the mining sector as one of the dirtiest economic activities currently killing the planet. In a similar way, the Oil and Gas (O&G) industry has been by far persecuted as contaminant-and-sustainably irresponsible. Contradictory to such bias, this abstract aims to summarize the results of utilizing an Artificial Lift Systems (ALS) technology from the O&G sector in mining applications to improve the efficiency of boron production in a project developed in Newberry Springs, California, United States of America (USA).

Boron is classified as a strategic commodity in many countries, including USA and in the European Union (EU). Borates are used in permanent magnets, adhesives, agriculture, borosilicate glass, Liquid Crystal Display (LCDs), fiber-optics, ceramics, detergents, fiberglass, flame retardants, fuel cells, lithium-ion batteries, alloys, nuclear reactors, personal-care products, and others.

This multi-year project was originally focused on understanding the mining application to evaluate the different ALS available, screening the lift options and finally coming up with the most suitable solutions to improve the efficiency of boron production. Boron is produced as a result from acid injections in a well, which is then soaked for a specific time. From there, a significant amount of non-pressurized boric acid, borates, and water are generated at 500 m (1500 ft) depth. The typical well completion comprises a 177.8 mm (7 in.) casing (CSG) x 88.9 mm (3 1/2-in.) Fiberglass (FRP) Tubing (TBG), a bottomhole temperature around 50°C (122°F) with an important concentration of chlorides, generating a highly corrosive bottomhole condition with no static pressure to lift these fluids to surface. Therefore, an ALS becomes the ideal solution for reliable flow assurance in mining applications. Based on well condition, a Progressing Cavity Pump (PCP) system was selected as the most suitable for this project. A summary of the conducted technical assessment for this project is shared for a better justification of the method selection. Nevertheless, due to the highly corrosive environment in this application, the selected PCP required exotic material on its components. A wide variety of tests were conducted to select the proper materials for the PCP system, including elastomer-compatibility, tube-corrosion, elastomer-tube-bonding, etc. In addition, alternative materials and coatings were explored on components like PCP rotor, sucker rod string, and surface equipment. The tests were conducted at downhole-temperature criteria that simulate operational conditions.

O&G industry know-how helped to enable food security through the deployment of a custom-made insertable-PCP (I-PCP) system that allows effective boron extraction in a mining application in California. For this specific case, the I-PCP increased production efficiency due to the combination of an abrasion-resistant rotor and a elastomer in the stator. PCP system equipped with a conventional sucker-rod string made of Hastelloy C276 and paired with an energy-efficient, permanent magnet motor drive head and is part of a proof-of-concept to apply traditional O&G artificial lift technology to effectively mine boron, a material deemed critical for the global-energy transition.

Key words: Boron, Solution Mining Applications, Oil and Gas, Artificial Lift Systems, Progressing Cavity Pump.