

Case study: Italy

Production Solution saves biodiverse-region operator \$4 million by removing scale, eliminating workover costs

To improve production from an oil well in an environmentally sensitive national forest, a customer in southern Italy installed electrical submersible pumps (ESPs) in an area known for scale deposition. The customer installed one upper and one lower ESP to serve as a redundant system in case one of the ESPs became clogged.

As part of the overall plan, the customer treated the well with a Baker Hughes scale inhibitor. By injecting the scale inhibitor continuously through a dedicated capillary tubing line, the customer hoped to prevent carbonate scale with a presence of discrete sulphate deposition.



First stage of ESP with accumulation of scale at the impeller.

The ESP intake and discharge pressures remained stable for five months and the well produced 8,000 BOPD (1271 m³/d) with only a 2% water cut. In the sixth month, however, the pressure began to rise approximately 7 psi (0.5 bar) per day, reducing the ESP discharge pressure. Without any intervention, the customer would have had to shut down both the upper and lower ESPs to avoid pump blockage, decreasing the overall production rate.

The downsides of conventional operations

The conventional option involved the acidification of both the ESPs and wellbore—a common practice in carbonate wells and a method the customer had already performed in other wells in the field. But, due to the location of the well in a biodiverse area, the potential health, safety and environmental (HSE) risks were too high. Additionally, the requirement to take the ESPs offline for the acid treatment would have a significant, negative impact on production.

The customer asked Baker Hughes for an alternative that would keep the ESPs in operation and avoid workover costs.

The promise of Production Solution

A Baker Hughes Production Solution team studied the data acquired from the company's **ProductionLink™ Expert artificial lift monitoring service** and analyzed a pulled ESP that had been deployed in the field previously to determine the root cause. The team concluded that, despite the current chemical injection regimen, the 50% increase in the production fluid's water cut had accelerated the scale deposition.

With an eye to keeping costs low and avoiding potentially damaging workover operations in the forest, Baker Hughes engineers suggested overdosing the wellbore with the existing scale inhibitor. Field personnel increased the scale inhibitor injection from 80 to 300 ppm for a period of 30 days. While the motor amperage rose, it was still not enough to restore the ESPs to optimum operating conditions.

Challenges

- Maintain production despite ESPs clogged with scale
- Minimize risk of future premature ESP system failures
- Avoid potential impact of workover operations in a national park

Results

- Restored production to original levels without taking ESPs offline
- Saved an estimated \$4 million USD in avoided workover costs
- Mitigated possible contamination in a national forest
- Developed precise chemical regimen to use in additional wells to curtail scale buildup in ESPs
- Experienced no HSE issues or nonproductive time (NPT)

Drawing on its expertise, the Production Solution team devised a new, more effective chemical treatment. To remove the scale in both pumps, the team suggested replacing the scale inhibitor with an environmentally friendly Baker Hughes scale dissolver. This scale dissolver specifically attacks barium sulphate scale in oilfield equipment and provides excellent scale dissolution under alkaline conditions like those in this field.

The customer agreed to the Baker Hughes proposal and the team implemented the strategy. The substitution of the scale inhibitor with the scale dissolver began at a rate of 460 L/d (121.5 gal/day). Over the next five months, the scale dissolver effectively dissolved the sulphate and carbonate deposits, restabilizing the ESP parameters and

fluids production to the original levels. The treatment proved so effective that the team gradually reduced the dosage from the initial injection down to 240 L/d (63.4 gal/day).

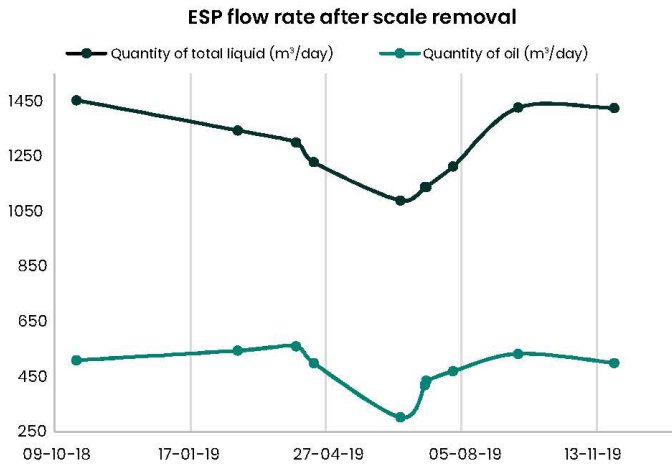
The Production Solution team optimized the quantity of the scale dissolver necessary to maintain the ESPs in the best possible running condition. With the precise amounts isolated, the customer would be able to switch to the scale inhibitor from the scale dissolver and back again as well conditions dictated.

The predictable performance of Production Solution

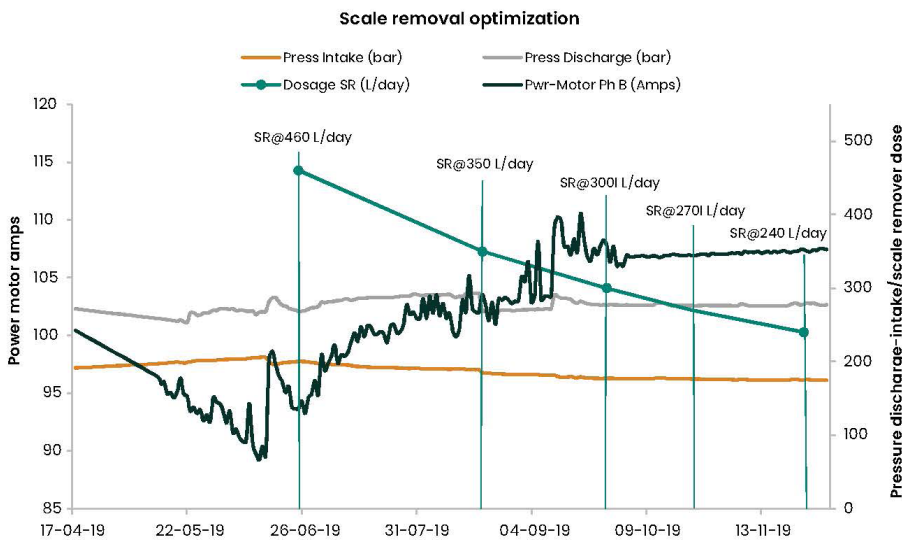
The innovative Baker Hughes Production Solution avoided ESP shutdowns, enabling the pumps to operate continuously during the chemical

treatment. The continuous injection of the scale dissolver through the downhole injection line below the ESP intakes increased the individual and overall ESP run life. As a result of the chemical treatment, both ESPs ran for a combined 1,108 days.

With the increase in the ESP run lives, the customer eliminated the approximately \$4 million USD cost and environmental impact of workover operations in the biodiverse region. By reducing the number of coiled tubing activities needed to treat the wells, the Baker Hughes Production Solution had a positive impact on the customer's overall HSE rating. The customer was also able to take the predictable performance of this chemical regimen and apply the best practices to other wells in the field.



The quantity of total liquid and quantity of oil gradually decreased because of scaling. After the implementation of the scale dissolver, oil production returned to optimal levels.



Over the course of five months, the effectiveness of the scale dissolver proved itself, enabling a gradual reduction of the amount needed to maintain ideal ESP operational parameters, a program the customer would use for future wells.

