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Report Title:	**Using Cable Suspended Submersible Pumps to Reduce Production Costs to Increase Ultimate Recovery in the Red Mountain Field in San Juan Basin Region**
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ABSTRACT:

A joint venture between Enerdyne LLC, a small independent oil and gas producer, and Pumping Solutions Inc., developer of a low volume electric submersible pump, suspended from a cable, both based in Albuquerque, New Mexico, has re-established marginal oil production from the Red Mountain Oil Field, located in the San Juan Basin, New Mexico by working over 17 existing wells and installing submersible pumps.

STATEMENT OF PROJECT OBJECTIVES

Resume marginal oil production operations in the Red Mountain oil fields located in McKinley County, New Mexico by installing a cable suspended electric submersible pumping system (HDESP), determine if this system can reduce lift costs making it a more cost effective production system for similar oil fields within the region, and if warranted, drill additional wells to improved the economics.

Two Phases of work have been defined in the DOE Form 4600.1 Notice of Financial Assistance Award for this project, in which the project objectives are to be attained through a joint venture between Enerdyne LLC (Enerdyne), owner and operator of the fields and Pumping Solutions Inc. (PSI), developer of the submersible pumping system. Upon analysis of the results of each Phase I, the DOE will determine if the results justify the continuation of the project and approve Phase II to proceed or terminate the project and request that the wells be plugged. This topical report shall provide the DOE with Phase I results and conclusions reached by Enerdyne.

PHASE I

The objective of Phase I was to attempt to establish marginal oil production. This was accomplished by selecting 17 wells within the oil fields, removing existing equipment when necessary, cleaning out each casing, treating the pay zone of each well for minor skin damage, temporarily installing a HDESP in each well, and determining the oil cut of the production. And to operate the field for a period of approximately one year to find out if electric submersible pumps are more cost effective to operate verse a typical beam pump system.

HDESP

A newly developed pumping system, the HDESP consists of a 3 ¾" diameter light weight low volume electric submersible oil well pump that functions by hydraulically actuating diaphragms with a small hydraulic pump and electric motor. This gives the pump the ability to pump low viscosity fluids as well as abrasives given up by the reservoir. By increasing the length of the diaphragms and or the size of the electric motor, the pumping capacity increases. Its stainless steel construction allows the pump to be deployed in corrosive down hole environments without damage to the components. It is suspended, in the well, using a ¼" D stainless steel cable to which the electric power cable and 5/8" reinforced polyethylene tubing, with a burst pressure of 2500 psi, are tied. The stainless steel cable is tied off at the wellhead while the power cable and tubing pass through. The entire system can be deployed, continuously, by one man operating the CSPS trailer, a 16' winch trailer that is equipped with hydraulically actuated spools that feed or gather the cables and tubing simultaneously.

For this project, the HDESP appears to be perfectly suited to handle the field conditions and reservoir characteristics of the Red Mountain: the lack of reservoir pressure that exists due to the shallow nature of the pay requires a pump that can pump off without damaging the pump. Those wells that experience sand entry into the wellbore from the formation require a pump that will not prematurely wear out from sand abrasion to its components. During the winter months it is extremely difficult to prevent low volume wells, that produce fresh water, from freezing and splitting wellhead fittings and valves or metal flow lines, therefore a production system is needed that is not exposed to weather conditions. And, because the field is remote, a production system that has no above ground moving parts that require maintenance or can harm livestock or other native animals is most beneficial.

At the date of this report all HDESP pumps are pumping with exception of one that was lost down hole during installation and one other that apparently has experienced a down hole electric motor wiring failure.

Well Tie-in

After a HDESP was installed, a 4"x 18"x 32" concrete pad, designed with openings to fit around the wellhead and also allow the electric cable and tubing to pass through, was place over the wellhead, production tubing and power cable, and the well was tied-into a power supply and gathering system. A 20 amp disconnect and 240 volt timer were mounted adjacent to the starter on the wooden post and wired together through plastic flex conduit. A power supply cable was run to the well in a 24" deep trench from the main power source, buried and then wired into the disconnect. The production tubing was coupled and run, underground, to a production tank. The wellhead was then covered by bolting a 8"x 16"x 22" metal box to the concrete base. The location was fenced with pipe panels or t-posts and barbed wire and the well was produced for approximately one hour per day.

RESULTS

HDESP

Only one HDESP pump has failed to date. It apparently has an electric motor wiring problem down hole because it will not operate past the start mode.

Production

The original plan for oil production was to allow each well to pump for a couple of days or until the well pumped off and then calculate the oil cut. The results would determine if the well was economic. It was found that the typical well made 8+ bbls. of fluid per day in the first four weeks of initial production, with the pump operating two hours per day. The average oil cut was calculated at 15%. Within a few weeks of pumping, the production tanks would be full and the produced water would require disposal. Once all wells were online, it was apparent that the volume of produced water was too great to manage. Therefore additional tanks have been placed within the field to handle the fluid volume, after all the wells were tie-in permanently.

Approximately 6000' of electrical cable and flow line were laid and buried within 24" deep trenches to permanently tie-in the producing wells. This task consumed most of the summer months. During this process, most wells were required to be shut-in and or produced sporadically. Currently, all producing wells are tie-in and capable of producing.

Economics

With current oil prices, the field is marginally profitable. Oil production is at approximately 6 BOPD with the potential of 15-20 BOPD once all wells are allowed to produce on a regular extended schedule. The big question, as in the past, is what to do with the produced water. Because the Red Mountain is unique, in that oil occurs with fresh water, a plan is being designed to put the fresh water to a beneficial use on the surface that will have a positive impact economically.

CONCLUSIONS & RECOMMENDATIONS

Oil Production

Marginal oil production has been re-established at the Red Mountain Oil Field using the cable suspended pumping system. However, in the previous topical report, it was recommended that in order for the field to be economic, produced water must be reintroduced into the reservoir to maintain reservoir pressure to increase oil production and as a method of water disposal. This recommendation may still be necessary. But, given the present need for fresh water in northwestern New Mexico, more specifically, the Navajo Nation, it is prudent to take full advantage of this basic resource.

Although the produced water is suitable for livestock consumption as is, a more beneficial use is now under consideration. With assistance from the United States Department of Agriculture, an area will be designated for a farm plan. The soil will be analyzed to determine a suitable crop, given existing conditions, and determine the chemical content of the produced water to find out if there are any dissolved solids the would hinder plant growth. Once this information is gathered, a farm plan can be designed for the quantity of water the field is capable of making. If this type of plan can be implemented, it would improve the economics of the field significantly.