Strategies to Mitigate Potential Problem During Planning and Designing a Geothermal Well

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Abstract

Prevention of a problem is more efficient than a cure. A number of methods are available to estimate the wellbore temperature profile and warn that a problem may be near: comparison of drilling fluid inflow and outflow temperatures; maximum-reading thermometers either run just above the bit or lowered through the drill pipe on a wire line; or onboard logging tools that can transmit temperature data in real time. During drilling, down hole data can represent reservoir conditions or drilling performance or both and this information can lead to: a change in drilling method for greater efficiency (and lower cost); a decision to set casing; initiation of lost-circulation mitigation; or possibly even preventive measures that can avert a disastrous loss of well control.

Aim

Although none of these is guaranteed to provide early warning of a potential kick, it is always important to know as much as possible about three main influential factors that have not yet been put together to mitigate the problems during planning and designing a geothermal well.

Introduction
As in many contexts, there are two separate but closely related parts of preparing for a drilling project—planning the well and designing the well. “Planning” means to list, define, schedule, and budget for all the multitude of individual activities required to drill the well, and “designing” means to specify all the physical parameters (depth, diameter, etc.) that define the well itself.

The geographical location of the well can have a major impact on cost, schedule, and even well design, but that choice is a function of exploration for the resource, and thus is too variable to be considered as a generic part of well planning. A special consideration in some regions is the possibility of encountering hydrocarbon resources while drilling the geothermal well. If this is the case, it can affect casing design, rig selection, mud logging requirements, and many other aspects of the well plan. In contrast to oil and gas wells, which are often over-pressured and where those pressures are controlled by weighted drilling fluids, geothermal wells most often are under-pressured. This means that the formation pressure is less than the drilling fluid head, which is the effect that causes lost circulation. That is why this problem occurs in many multi-zone geothermal production wells.

The primary method of detecting the driving problem over a certain drilling project is being familiar with the aspects of these three main influential factors that have not yet been put together, titled below as:

1.1 Driving Cost Reductions In Drilling Operations

Pre-planning your pad drilling operation helps too. It brings reduced risk of collision with older wellbores, less directional work, reduced cost and better hole quality. To have a pad drilling operation set up for next year, it should be planned three years back. The biggest expense in drilling is the daily rig rate, which should be negotiated with the rig supplier. Narrowing down the operational specifics of each play. "Cementing, casing, drill pipes, rented equipment, production facilities, water requirements, etc all need to be taken into account for cost reduction.

With multi-well pad drilling, costs can be shared and spread across the wells. The completions team can optimize the number of stages and minimize the number of days it takes in completing the wells. Drilling engineers should consider the range of options available in the drilling fluid market. The cost of the drilling fluid represents about 5% to 10% of a well cost. With good mud engineers, significant cost savings can be realized if a drilling fluid that works adequately is correctly designed. Costs can be reduced by using water-based fluids. Minimizing service requirements and renegotiating all service contracts with suppliers can reduce costs, especially now when the markets are uncertain. Improving rates of penetration [ROP] is essential to drive down costs through advanced design of drilling parameters, such as rotary speed [RPM] and weight on bit [WOB] as well as identifying the performance qualifier, such as footage drills, down hole tool life, vibration control, durability and steer ability. To increase ROP needs to figure out ways of reducing NPT [Non-Productive Time], flat time, how much mud weight affects ROP? how bit [RST] match up and [BHA] design affects ROP? Understanding the relationship between ROP and efficiency - the cost per foot assure to reduce that number. The key aspect to understanding efficiency, which translates into higher ROP, is communication between the team in the office and the drillers on site.
1.2 The Right Rig for The Job

Most of the criteria used to select a drill rig will be derived from well parameters; specifically diameter, depth, and casing design. The basic difficulty is the availability and timing. The various high-cost areas in a drilling operation, starts with rigs. When choosing a rig few factors need to be in to consideration. It depends on whether the rig is walking, sliding or skidding; the type of package to go with the rig; the pump sets, loop load, settling tanks, it has, When to focus on standing the rig? Is the rig equipped to walk ? whether the rig needs to be equipped with the Veristic Rig Walker or something similar, whether the rig can be retrofitted for any existing rig either directly to the substructure or through the use of a pony sub? Does the rig have the ability to skid in eight directions? Does it require modifications to the electric cable trays or to the flow line, choke line or kill line? What is the derrick configuration [e.g. 25,000ft]? How many wells per pad can a rig drill [e.g. 28 wells per pad on 10ft spacing, or 16 wells per pad on 20ft spacing]? Would the solids control system need evaluating for improvements with regards to multi-well pad drilling to minimize problems with solids in the active pit system? Is the blowout preventer trolley system? The sort of flowing depth, whether the rig can skid or walk with the drill pipe in the derrick as opposed to having to lay it down ,pit system and mud pump minimizes the number of pads needed to develop acreage and design a preferred pad orientation. For instance for 1,600 horsepower rig at 10,000 feet psi. gives 7,500 feet psi to work with which is great. A conventional rig has a lesser day rate and is very suitable for short-term drilling operations. In cases of multi well pad the advances are rig release to spud in 24 hours, no need to refurbish location between wells, reduced mobilization-demobilization for drilling and completions, a potential cost saving of USD$750,000 and above per well, less lost circulation and no damage to existing well bores during completion. Once these are done, then approach drilling contractors to see when the rig is available. The fastest availability is usually 90 to 120 days.

1.3 The Cost Benefits of Reusing Drilling Fluids

Because any losses will drive up costs, it is a means of breakdown of well cost. Reusing drilling fluids in general depends on these three essential factors:-

a. An end-of-well analysis (Does the drilling fluid need improvement? Where can it cut cost? Is the current drilling fluid meeting expectations?)

b. Reviewing, planning (What are the options? how to go for designing the pad? How to close the reserve pit once drilling the well gets finished? How big does the well have to be? )

c. And implementing changes.

A closed-loop mud system helps save money on hauling off liquid and solid waste; to reduce the amount of water needed to drill and to usually save the whole mud. Reusing drilling fluid from well to well involves recycling base fluid captured from drill cuttings to build and maintain drilling fluid using the chemistry and the mechanics to separate the fluid from the cuttings. Oil-based drilling fluids are reusable, fairly non-reactive to formations works with multiple base oils. Reusing water-based mud is a little more difficult but very doable. Products use with water-based mud are sensitive to bacteria. You could have viscosified fluid on one day, but the next day
it turns to creek water. To keep the temperature maintained with season change (winter), is difficult unless you have steam lines. However, certain drilling fluid properties solids control and good drilling fluid engineering go hand in hand in making reuse of drilling fluid cost-effective. The backbone of any plan for reusing drilling fluids is to optimize the solids control system, because an optimized solids control system is proven to reduce costs.

Conclusion

To elaborate these detailed strategies on how to improve drilling process for even a single well needs a sizable volume in itself. An integrated view of these three essentials predicts the successes of ongoing project.

References


*Development at Fenton Hill, New Mexico, Oregon Institute of Technology GHC Bulletin* (2002).


