Percussion-Enhanced Drilling Technology Supercharges Drilling Performance

Presented by Marc Anderson
Record Breaking Drilling Technology

• Novel Percussion-Enhanced Rotary Drilling System

• Field Trials Q2 2023

• Drilled 2x Faster

• Drilled 3x Further

• Deep, hot, hard rock applications

• Plug and Play into conventional drilling systems

• Transformational for Geothermal Economics
Influence of Drilling Cost on Geothermal

- LCOE for geothermal $56/MWh
  Solar PV $51/MWh, Onshore wind $52/MWh\(^{(1)}\)

- Drilling costs **30%-50% of CAPEX\(^{(2)}\)**

- EGS/AGS $100/MWh, **75% of CAPEX\(^{(3)}\)**

\(^{(1)}\) Timilsina, 2020, (2) Dumas, Antics and Ungemach, 2013 (3) Flowers, 2021
How to Reduce Drilling Costs

TIME = COST

Reduce time to drill well

HOW

Drill Faster – increase rate of penetration (ROP)

Increase drill bit longevity – reduce flat (tripping) time and bit costs
Percussion and Drilling

• Rapid hammering action - crushing failure of the rock

• Proven to increase drilling ROP by several factors

• Widely practised

• Difficult to achieve downhole
  - Reliability/Longevity
  - Power
  - Well management issues
Percussion-Enhanced Rotary Drilling

- Rotary drilling with PDC bit
- Percussion impulse action additive to weight on bit
- Pre-fractures (softens) the rock
- Increases depth of cut of bit
- Reduces wear on cutting structure
- Low impact to drilling systems
Percussion-Enhanced Rotary Drilling

- Increases ROP
- Increases bit longevity
Percussion-Enhanced Drilling System

- Plug-and-Play
- Hydraulically powered by drilling fluid
- Automatically operates when drilling
- Introduces no pressure drop
- Full metal valving
Bench Testing and Results

Bench Testing at HydroVolve Drilling Test Centre, Aberdeen

ROP Increase x2.6

Inactive

Active

- ROP m/hr
- DOC mm/rev
Field Trial Record Breaking Performance

- **Three** sizes deployed: 6” | 8-1/2” | 12-3/4”
- **Fastest** ROP ever recorded in extensively drilled basin
- **Longest** drilled interval ever recorded in extensively drilled basin
- **Doubled** (2x) ROP field average across multiple bit providers
- **Tripled** (3x) distance over field average across multiple bit providers
Flow durability >350hrs circulating with 2.1Sg mud in a single deployment.

Thermal stability >28days on bottom at >220 degrees C

Mechanical reliability >250hrs drilling time in one run at >220 degrees C

System and bit durability >600m interval, shoe-to-shoe in one run, against best offset well of 220m interval

Successfully drilled out a shoe track

Proved capability of TERRABIT PDC drill bit
Case Study

6” Percussion-Enhanced Drilling System c/w Bespoke PDC Bit

• Deep S-shaped profile well
• Inclination below 20 degrees
• Total depths in excess of 6000m
• High contrast in lithologies varying between
  • 5-8 kpsi shale
  and
  • 22-25 kpsi sandstone reservoir and limestone stringers
Case Study Results

GeoVolve HYPERDRIVE c/w TERRABIT v’s offset
Case Study Results

Combined actual and projected results against offset:

- Drilling Time Saving: 7.0 Days
- Flat Time Saving: 19.7 Days
- Total Time Saving: 26.7 days
- Drill Bit Saving: 4 Bits

Projected total saving for 600m, 6” interval:

$1.424m
Record Breaking Drilling Technology

• Novel Percussion-Enhanced Rotary Drilling System
• Field Trials Q2 2023
• Drilled 2x Faster
• Drilled 3x Further
• Deep hot hard rock application
• Plug and Play into conventional drilling systems
• Transformational for Geothermal Economics
What is Next?

• Building inventory throughout Q1 & Q2.
• More pilot wells.
• Multiple, confirmed drilling campaigns with operators to complete throughout 2024.
• Nominated for the Ruggero Bertani European Geothermal Innovation Award!
Many Thanks

Thank you for listening.