NTGA Updates: Asset Management Experiences
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NTGA Geothermal Energy for 2017

- 5.95 PJ, Direct use, 40%
- 4.28 PJ, Reinjected/flashed, 29%
- 0.26 PJ, Other system losses, 2%
- 4.33 PJ, Power generation, 29%

470 MW, thermal
74 MW, electric
NTGA Steamfield Operations

7 production wells
5 re-injection wells
7 two-phase separators
2 high-pressure clean steam plants/reboilers
Pipelines – two-phase, steam, geothermal water, steam condensate
DCS-enabled operations
Case Studies

The Trouble With Anti-scalant Systems
Challenges Upgrading Antiscalant Systems at NTGA

Armoured ¼” Antiscalant tubing installed into NTGAL Production wells.

Original period between HTCCs’ was 20 years with very little requirement for regular PTS testing.

Design required wells to be quenched to remove the dispersion head and close master valve

Increased requirements for reservoir data and asset integrity certainty means minimal quenches.

System redesigned to accommodate regular well testing.
Wells With Non-Retrievable Tube

KA35 HTCC 1999 20 year cycle  
KA19 HTCC 1995 20 year cycle  
KA27 HTCC 1999 20 year cycle  
KA47 HTCC 2010
KA47 Well

KA47 Well: Completed January 2008

Large Bore Well 2070 MD

Central to NTGAs’ Kawerau Field

600 t/hr TMF (20 MWe)

Supplies Clean Steam Plant and CHH Wood products
KA47 time line

• Post commissioning, hot fluids permeated the well pad outside of the cellar and 30”/20” annulus
• Chemical analysis determined fluids likely originated from near surface aquifers with ground water mixing
• 2009 annulus was tested for tracers injected into KA38,39 and 40 shallow reinjection wells. +ve returns found, reinforcing shallow aquifers were the cause.
• 2010 Annular cement sealing attempted but unsuccessful.
• Casing annulus gland sealing caps fitted with valves to allow sampling.
• Could not carry out integrity testing because of anti-scalant design and lack of capacity to take well out of service.
KA47 time line and plan

- KA54 well was commissioned on 5th June 2016
- KA47 taken out of service on 8th June 2016
- Work package for KA47 included:
  - Quench
  - Remove 1.9” hangdown string and old armoured tubing/Install new design
  - Well integrity testing
    - HTCC
    - Injection PTS
    - Kinley Caliper
    - Camera
KA47 injection PTS
KA47 Kinley Caliper
KA47 repair plan

Run a 10 3/4” Scab Liner the full length of the 13 3/8 casing. Cement back to surface with high density cement slurry

Challenges:
Master Valve was fitted 2 meters above ground level.
No available rig could fit over. CHF needed to be lowered to just above GL and the Master Vv refitted.

KA37 Production well was too close to KA47.
Too close to allow for a larger MBC rig or IDC rig due to sub base design.

Cementing the liner back to surface.
10 ¾ “ Liner collars machined at AIE to give extra clearance for cement.

Economy: Mobilisation costs of a large rig such as MBCs’ or IDCs’
A rig similar to MBCs old rig 16 would be needed but that is decommissioned.
KA47 repair
KA47 repair

Packer before insertion into lubricator
KA47 repair

Adjusting the CHF position for the rig with the packer set
KA47 repair
KA47 repair

Webster VR 500 Nova -1 Rig
KA47 repair

Bore Hole Schematic
Well ID: KA-47
Report Date: 05-Jan-08
Well Name: Kawento 47

Current Indicated Status

- 34" Casing set at 3456 ft on 28-01-07
- 10" Casing set at 7708 ft on 19-03-07
- 6" Casing set at 11220 ft on 25-06-07

Actual Data

- 12" Diameter drill hole at the Original RSB elevation
- Original RSB elevation at 8:750 ft above datum level

Leakage points observed:
- 12" to 15" Diameter Suction Injection
- Provision to complete through casing - connection made at 2710 ft
- Provision for 26" Diameter Suction injection
- Provision to achieve 12" Diameter Suction injection
- 12" Diameter Suction injection at 7708 ft on 28-01-07

Straddle aquifer flush to surface on 26-01-07, around 32" casing and 40" conductor

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Case Studies

The Acid on KA27
KA27 Well

KA 27 Well: Completed May 1979

Large Bore Well 1546 MD

240 t/hr TMF (7 MWe)

Supplies Norske Skog Mill
KA27 time line & plan

- May 2017 - KA27 taken out of service
- Work package for KA27 included
  - Quench
  - Remove old armoured tubing/Install new design.
  - Well integrity testing
    - HTCC
    - PTS
    - Top heat/compress and return to service

Risks: Scaling potential /well history.
Reserve funds approved for an acid job should tube prove stubborn to remove.
Scaling potential was analysed, risk was low.....
KA27 scale

30th June: Scale from KA27 Tube
KA27 acid flush

22\textsuperscript{nd} June: 74000 Litres of Acid Mix applied to well and then flushed.

23\textsuperscript{rd} June: Tubing pulled minus the 4 meter dispersion head and 11 meters of tubing. !! Water still flowing down the well.

Gauge ring runs Commenced. 7, 6.5

Multiple blockages occurred and cleared by pumping.

7” broach was run which dislodged scale blocking well. Had to be pumped several times up to 100 bar to break free. Finally blocked and would not clear.
KA27 blockage

- 20" (ID=0.48m) Casing Shoe 29.11 m
- 16" Casing Shoe (ID=0.39m) 106.38 m
- 11 3/4" (ID=0.28m) Casing Shoe 214.28 m

Wall Obstruction @ 610m
Top of 6 5/8" Liner 617m
8 5/8" (ID=0.21m) Prouction Casing Shoe 654.86 m
FLASH POINT: 680 m

Feed Zone
1300 m
1450 m

Possible Fish at bottom of hole
Consists 4" x 4m Weight bar with 11m of 7/16" Armour tubing
6 5/8" Liner (ID=0.21m) 1544.2 m
TD 1545.7 m
KA27 mechanical clean-out

Coiled Tubing Unit at work on KA27
KA27 mechanical clean-out

NTGALs Silencer Arrangement
KA27 lives again!
Kia ora!