ESP in geothermal applications

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EuALF 2018 European Artificial Lift Forum
13-14 June 2018, AECC, Aberdeen, UK

June 27, 2018

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Definition: geothermal energy

“Energy obtained by extracting the earth’s internal heat”

Low-enthalpy systems:  < 200 °C

Current capabilities of ESPs
• Max. 100,000 BPD
• 1700 BHP @ ~150°C

Used for
• Electricity generation (binary power plants)
• District heating / industrial purposes

Simple schematic of a organic rankine cycle power plant
Specifics in ESPs for geothermal

**PUMP STAGES**
- Bolted bowl pump stages
- Bronze alloy metallurgy
- Corrosion resistant

**MOTOR**
- Theoretical: 2800 BHP induction motors in tandem
- 175°C Max
- > 80% Efficiency

**SCALE INHIBITION**
- Biodegradable scale inhibitor in testing
- Specialized coatings for bearings
Unterhaching, Germany

Southern Germany Molasse Basin

Kalina Cycle Power plant 3.6MWe, 38MWth

- 2 wells at 3200m
- Temperature: 125°C (257°F)
- ~68,000 BPD (130 l/s)
- Unique biodegradable scale inhibitor in testing phase
- R&D Funding support from German Government

Graphic: GeotIS, https://www.geotis.de/
European geothermal market

**CURRENT / FUTURE LANDSCAPE FOR LOW ENTHALPY SYSTEMS**

- 280 district heating systems in operation, 160 more under investigation (2016)
- 10% Annual Growth between 2012 and 2016
- France, The Netherlands, Germany and Hungary

![Graph showing thermal production GWh]

**TOP 7 COUNTRIES**
(production in GWh, 2015 data)

1. Iceland (6421)
2. France (1335)
3. Germany (662)
4. Hungary (380)
5. Austria (272)
6. Italy (249)
7. Serbia (243)

Source: European Geothermal Energy Council 2016
Conclusion

GEOTHERMAL: AN OIL AND GAS PLAYGROUND

• Opportunities to develop high voltage, high temperature ESPs

• Embrace synergies between petroleum and geothermal industry

We have the responsibility to develop and contribute to green energy production