



JOOP ROODENBURG

DAP SYMPOSIUM 2017

# THE HURDLES OF THE GEOTHERMAL INDUSTRY AND THE POTENTIAL SOLUTIONS

# GEOHERMAL HURDLES

- We're currently in the transition from an hydrocarbon based society towards a sustainable energy based society
- The promising geothermal industry is relative young in the Netherlands and going through a very dynamic development
- Much of the needed experience is used from the drilling industry which was primarily developed for the oil & gas industry
- Due the many similarities with the hydrocarbon industry, the differences cause a series of **hurdles to be taken to make the geothermal industry successful**

# THE GEOTHERMAL BUSINESS CASE

- Energy content:
  - Burning 1 m<sup>3</sup> of diesel ~36000 MJ/m<sup>3</sup>
  - Harvesting of 60 Celsius heat out of salt water ~260 MJ/m<sup>3</sup> (*140 times less!*)
    - Source Binas / Wikipedia
- Burning of 1 m<sup>3</sup> of diesel produces ~2,7 tonnes or 1550 m<sup>3</sup> of CO<sub>2</sub> while geothermal energy can be harvested CO<sub>2</sub> neutral
  - source <http://www.icbe.com>
- Hydrocarbons are so profitable that a global market of users and producers exist while geothermal energy can only be used in the direct vicinity of its production location

**An hydrocarbon business case is easy to make profitable when CO<sub>2</sub> impact is ignored  
&  
Geothermal energy market is very local**



# OIL & GAS DRILLING LEGACY

- Oil & gas are over-pressured, relative easy to produce but geothermal energy needs to be pumped out in 1 well and back in the ground in a 2<sup>nd</sup> well
- Oil capacity limited by production rate of viscous oil or amount of gas trapped while geothermal production limited by heat demand, pump pressures and financing
- Most geothermal drilling hazards are ***not*** related to the reservoir opposed to hydrocarbon drilling in overpressured reservoirs

**Legislation, drilling & production technology and geological knowledge are based on the oil & gas industry**





# URBAN GEOTHERMAL DRILLING FOR CITY HEATING

- Urban drilling areas often require special attention to minimize environmental disturbance due to noise, light, logistics
- Drilling risk contours more relevant in populated areas
- Directional drilling in relative large sizes is needed to ensure sufficient distance between producer and injector well
- Innovative technical solutions to reduce drilling risks and environmental disturbance available but expensive due to **niche** oil and gas applications

Drilling technology specifically for urban drilling is needed



# DRILLING RISKS AND COSTS

- Geothermal budgets are tight and risks need to be mitigated by expensive insurances or pushed down to suppliers
- Risk related costs and learnings often limited to 1 project
- Lumpsum drilling is easier to finance but in general not cheaper if not well performed due to poor risk control
- Currently, lumpsum suppliers are often drilling contractors because they account for the largest share of time-based cost even though they have limited control on the operations
- Capex budget strain results in sub-optimal wells with respect to its full life cycle for example corrosion in single wall wells without production tubing

**Crucial to spread risk related costs over *multiple* projects & to build learning curve**

**Total life cycle to be considered when constructing wells**

**Fit for purpose rigs with better risk control is key for lumpsum drilling**

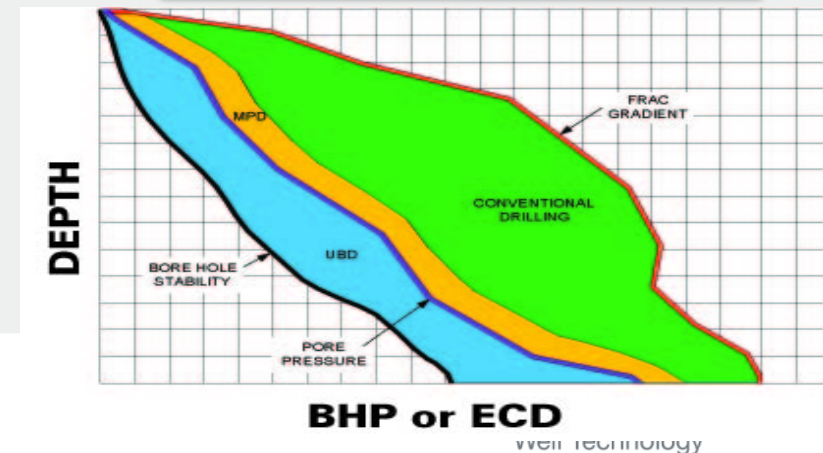
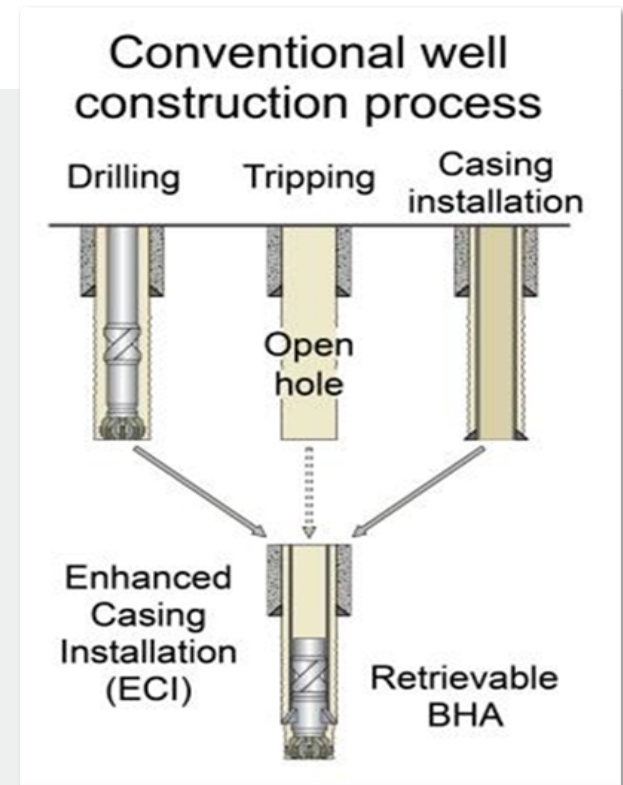
# TAKING HURDLES: GEOTHERMAL RIGS

- Huisman LOC400 returned to NL for geothermal drilling is used as base to develop geothermal drilling technology
- Geothermal rig for lumpsum drilling needs to be:
  - Highly productive to drill more wells per year
  - Have strong focus on NPT avoidance
  - Capable to offer additional services
- Purpose built geothermal rig under development:
  - AC driven for reliability
  - Compact
  - Silent
  - Fast moving with minimum of logistics
  - Highly automated for high performance and safety
  - Integrated services making niche and risk reducing technology affordable



# REDUCING RISK AND TIME WITH RIG INTEGRATED TECHNOLOGY

- Enhanced Casing Installation system:
  - Less critical steps
  - Minimum of geological impact
  - Higher productivity
  - Less pipe handling
- Managed Pressure Drilling:
  - Significantly safer drilling for urban areas (500 times!)
  - Higher drilling rates
  - Produce & test reservoir while drilling to minimize skin





# SMALL FOOTPRINT RIG WITH CLOSED-LOOP DIRECTIONAL DRILLING



## Enhanced Casing Installation



# RISK AND TIME REDUCING INTEGRATED TECHNOLOGY

- Automated directional drilling:
  - Minimum of people onsite monitored remotely
  - Less electronics for higher reliability
  - Expensive service provided under control of contractor
- Composite casing (drilling):
  - Eliminate corrosion and prolong well life
  - Alternative for double walled well designs
  - Use smaller rigs on smaller locations



# TECHNICAL HURDLES ARE “THE EASY PART”

WITH THE SAME PASSION WE CAN OVERCOME THE “NON TECHNICAL ISSUES”

- High level support, governmental commitment and early SodM involvement needed regarding geothermal specific drilling and production technology development and implementation roadmap
- Reduce drilling and reservoir related risks by promoting geological knowledge sharing and reprocessing/shooting of seismic data
- Until geothermal industry has matured sufficiently, a rolling fund is needed to spread risks over the various projects instead of pushing risks down to contractors or paying expensive insurance fees
- Pre-drilling phase to be simplified & shortened to reduce project uncertainties resulting in larger scale industry with continuous multiple rigs drilling

**A significantly more sustainable energy industry will rise if these hurdles are taken successfully**

**Taken the hurdles successfully will create opportunities to expand Dutch solutions abroad**

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