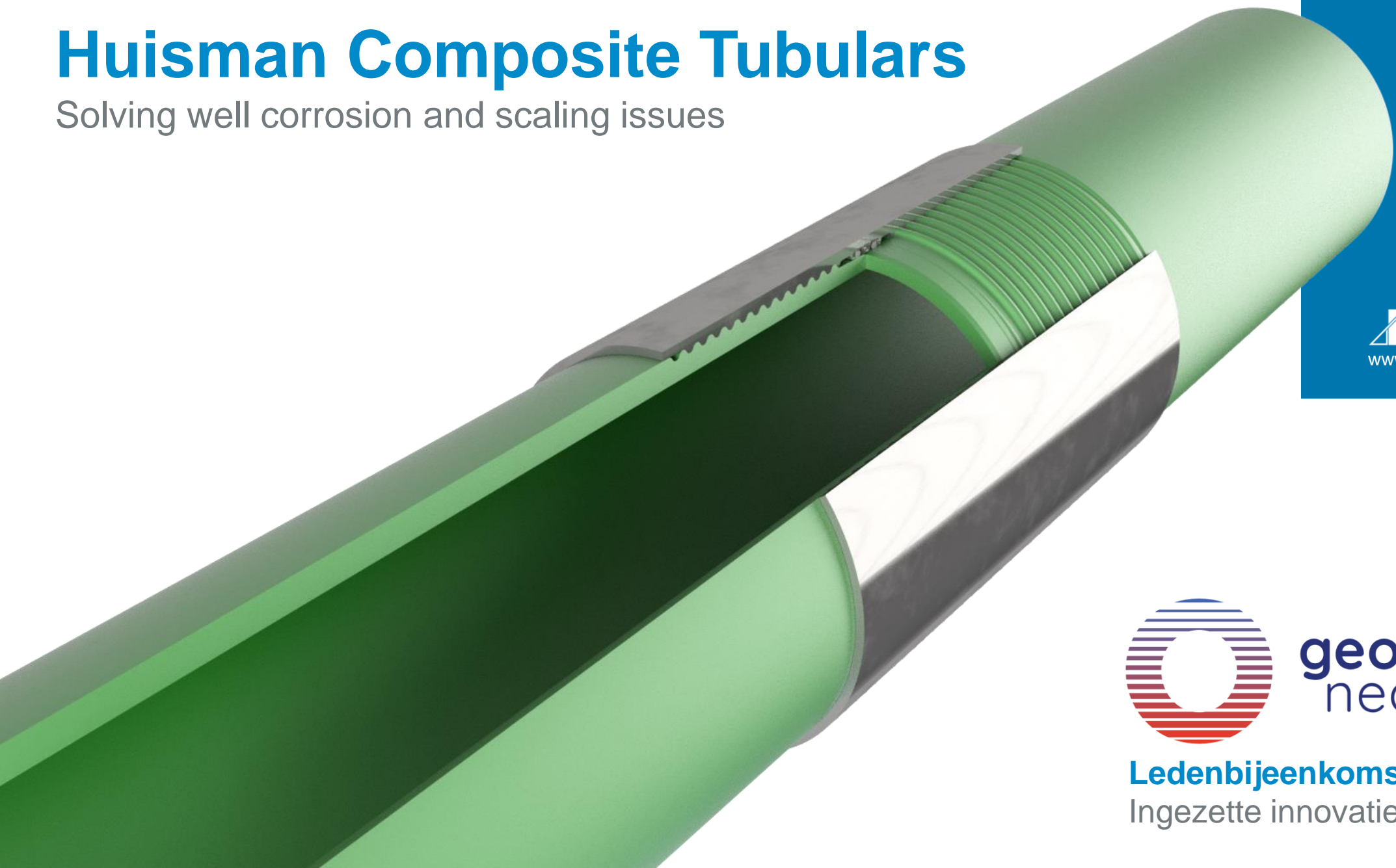


Huisman Composite Tubulars

Solving well corrosion and scaling issues



Huisman
www.huismanequipment.com



geothermie
nederland

Ledenbijeenkomst – 13 April 2023

Ingezette innovatie initiatieven

HUISMAN

EQUIPPED FOR IMPACT

"Accelerate growth of renewable energies and make conventional industries more sustainable"



HUISMAN COMPOSITE TUBULARS

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WELL CHALLENGES

CORROSION AND SCALING

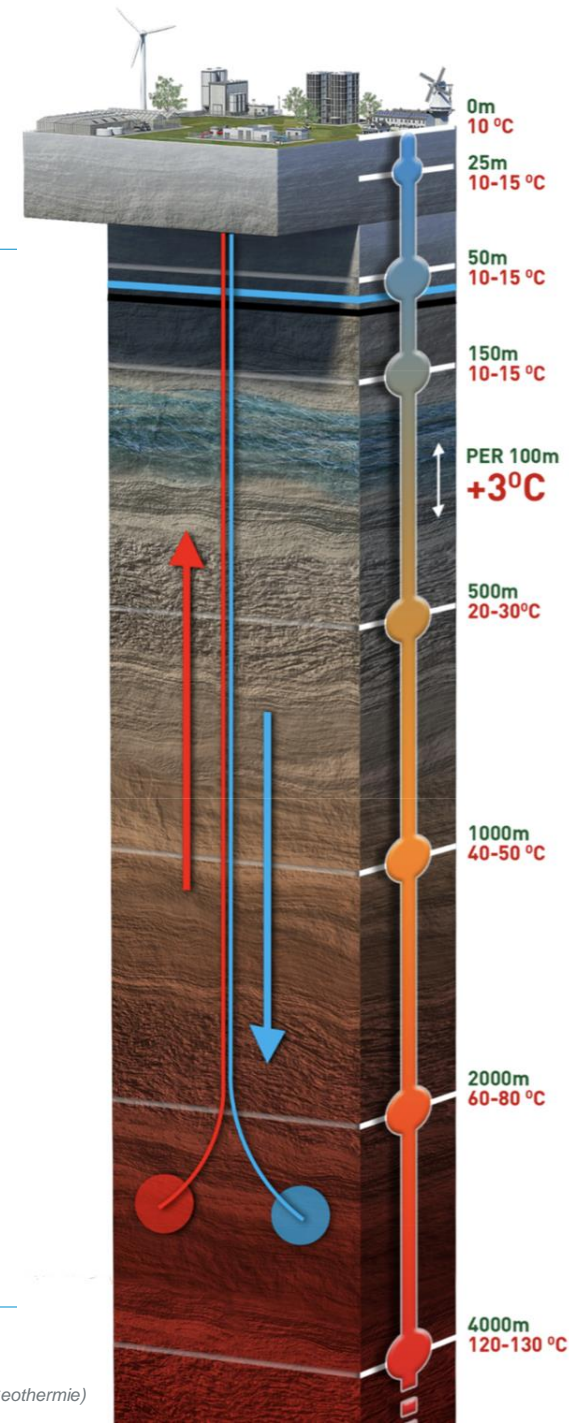
Corrosion and Scaling are major challenges for the geothermal wells
(Corrosion Review and Materials Selection for Geothermal Wells, 2017)



Corroded casing (Source: petroskills.com)



Scaling in a geothermal application (Source: vito.be)



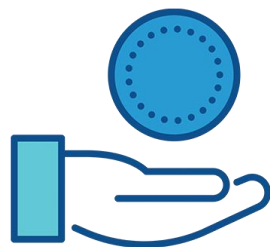
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VALUE PROPOSITION

HCT with MaxFlow™ connection

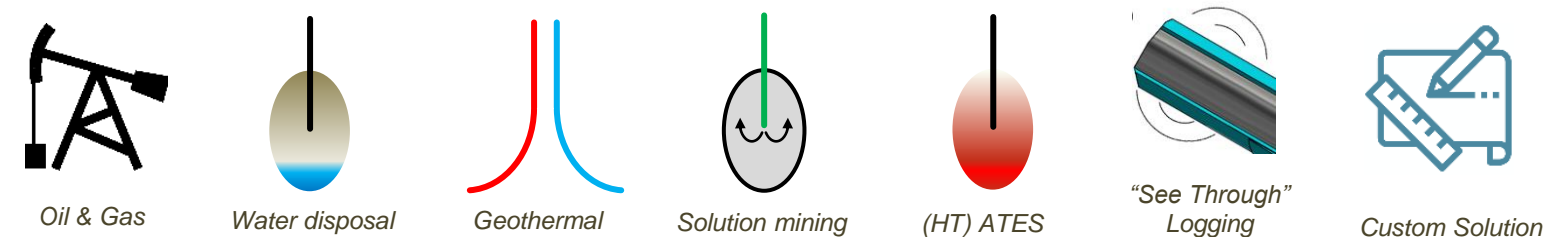
Robust composite tubular for downhole applications:

- No corrosion → Reducing risk on loss of well integrity, saving on inhibitors
- Mitigating scaling → Exceptionally smooth and fully composite flow path, low pump losses
- Ultra slender connections → Maximum flow area mitigating pump losses and saving cost
- Robust threaded connections → Make-up and break-out multiple times
- Lightweight string → Less intrusive installation and workovers saving cost



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APPLICATIONS



Application

Application Requirements

- Field parameters
- Dimensions
- Load spectrum



Solution Development

Product Specifications

- Dimensions
- Load ratings
- (Custom design)

Huisman Composite Tubulars and MaxFlow™ connection technology

Huisman Composite Tubulars:

- Casing
- Tubing
- Liner
- Tieback
- Window (sidetrack or monitoring)
- Guide shoe, etc.

Savings:

- Inhibitors / scale removal
- Pump energy cost
- Well integrity related NPT & workovers
- Carbon footprint
- Installation risk

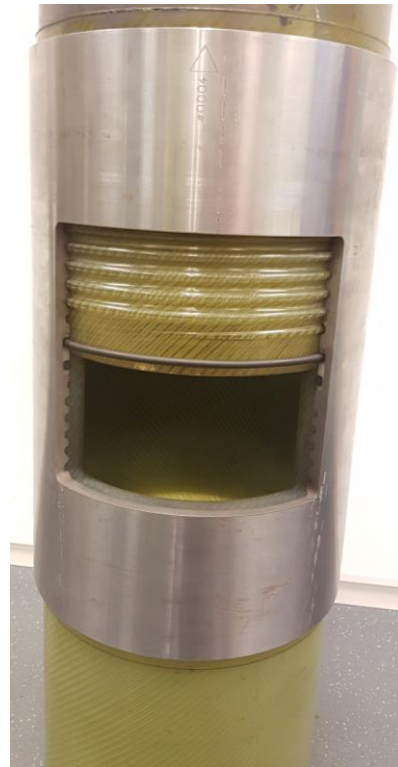
Tubular specifications (and thus the load ratings) are **highly customizable** outside the nominal range, enabling fit for purpose design to suit application specific requirements

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STEP CHANGE TECHNOLOGY

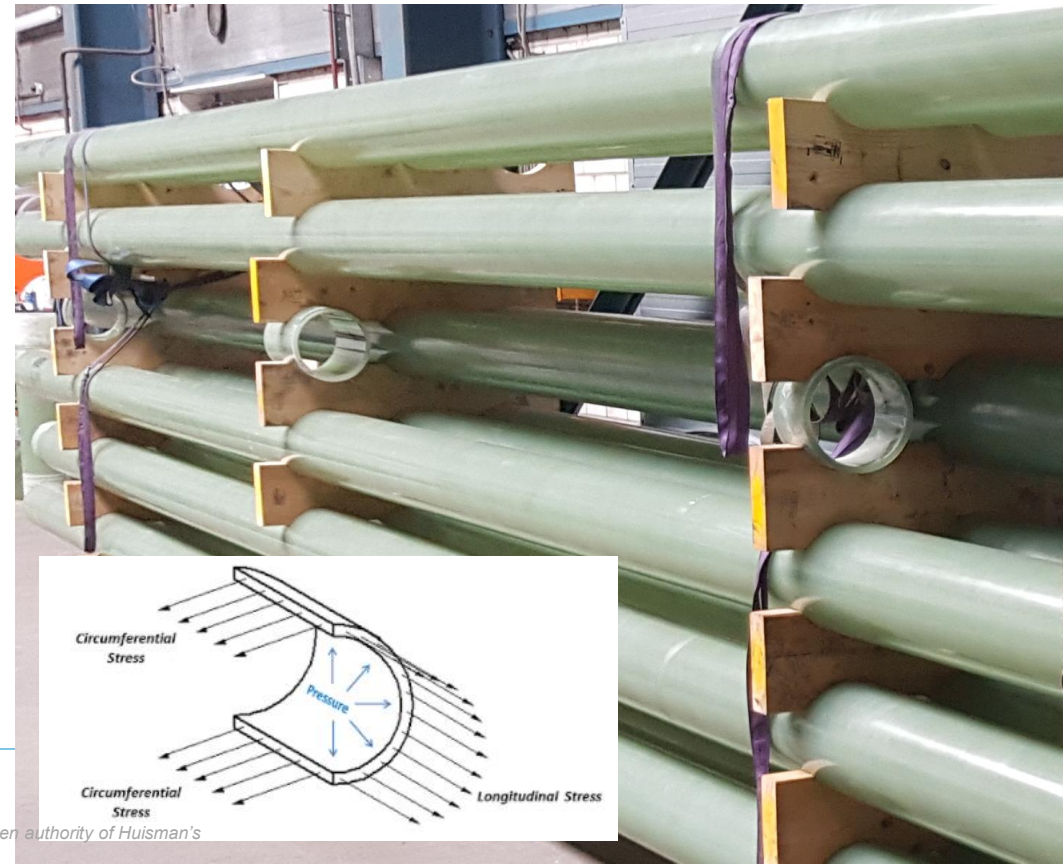
1. Slender threaded connection (MaxFlow™)

- Maximize ID in available space envelope
- Robust and reusable (multiple MU/BO cycles)
- High load ratings



2. Composite Tubulars

- No voids (no air inclusions in pipe wall)
- Optimal fiber orientation and Consistent dimensions
- Smooth surface



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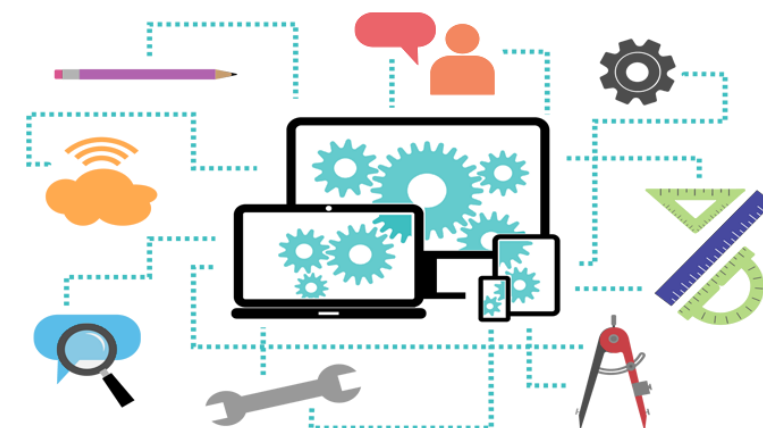
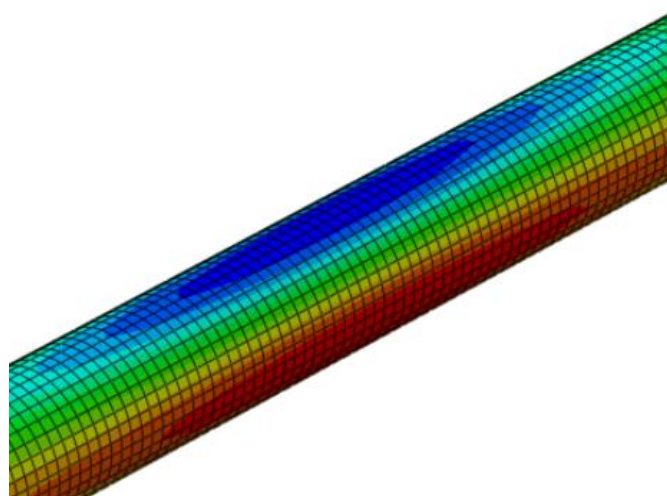
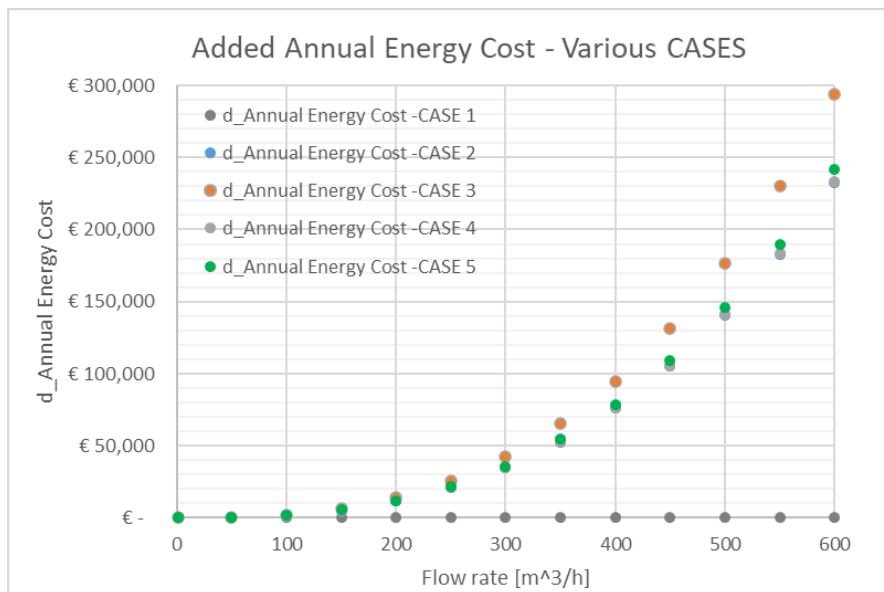
ADDITIONAL SERVICES

Techno-economic assessment

- Cost-Benefit analysis for the lifetime of the well, comparing various well designs on CAPEX, OPEX, HESQ, Carbon footprint.
- Definition of application specific load cases
- Analysis of stresses and resulting Safety Factors
- Design of custom solutions where needed (Tubular and connection dimensions, Polymer properties, Fiber layup, Cross overs and interfacing)

Hands on support

- Installation-, testing- and inspection procedures
- HCT tubular running services



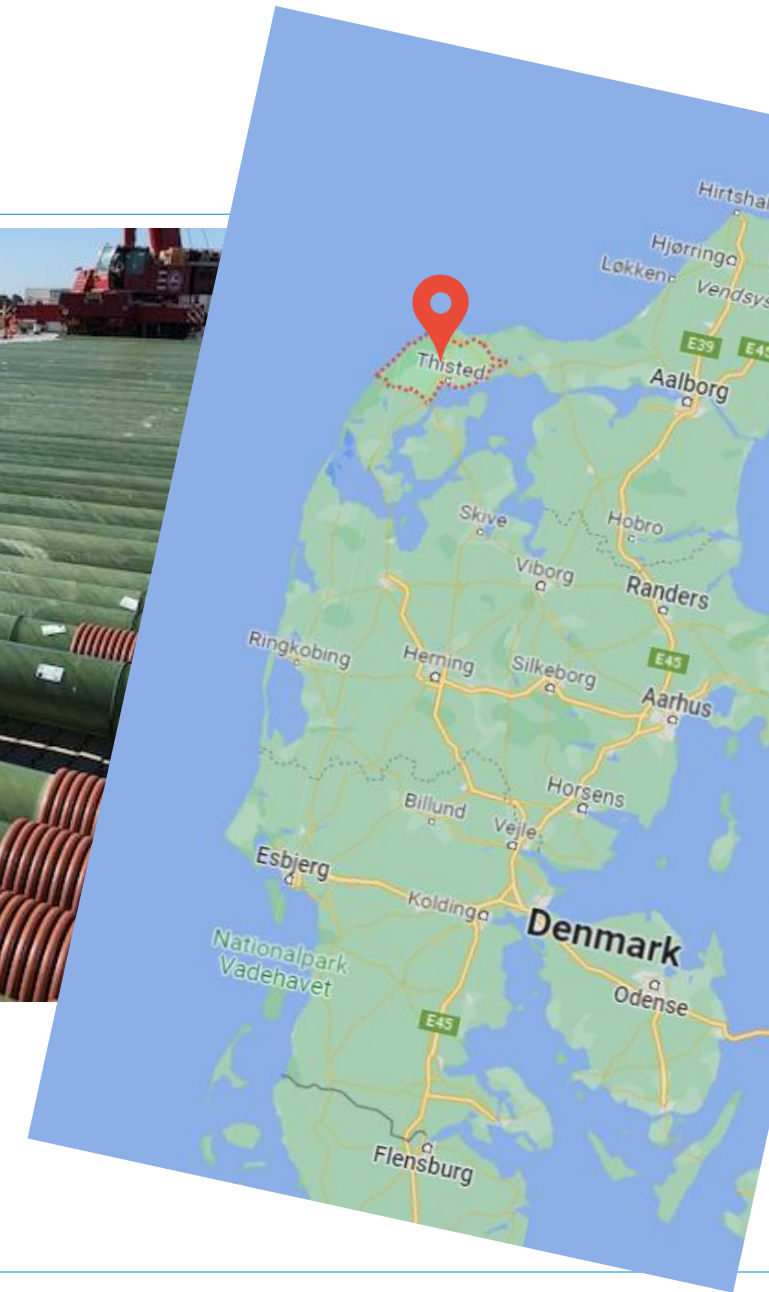
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APPLICATION: TIEBACK

Crane based installation

Workover platform

Pin protectors

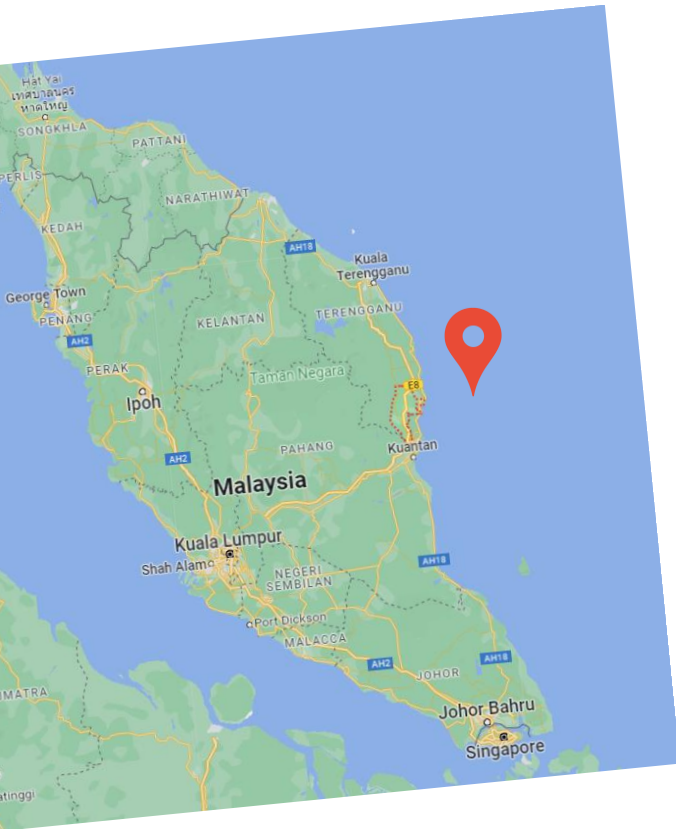


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APPLICATION: SEE THROUGH JOINT

Huisman Enhanced Casing Installation System (Casing while Drilling level 3)
Composite enabling **logging through casing**

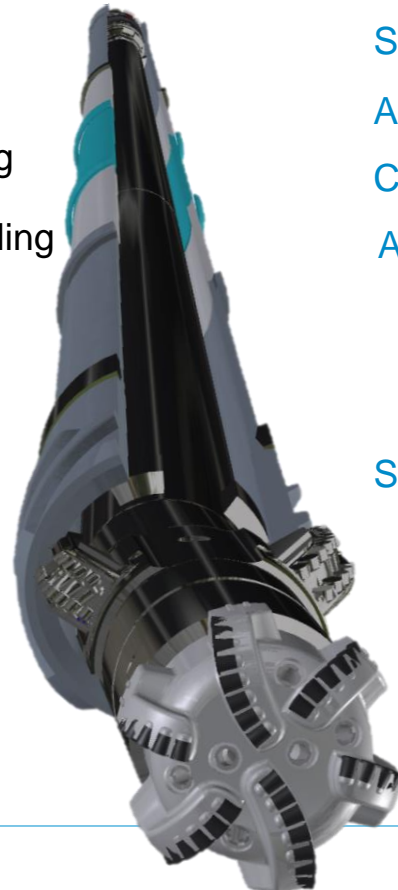


Internal BHA

Lock Down Device
Logging While Drilling
Measuring While Drilling

Under Reamer

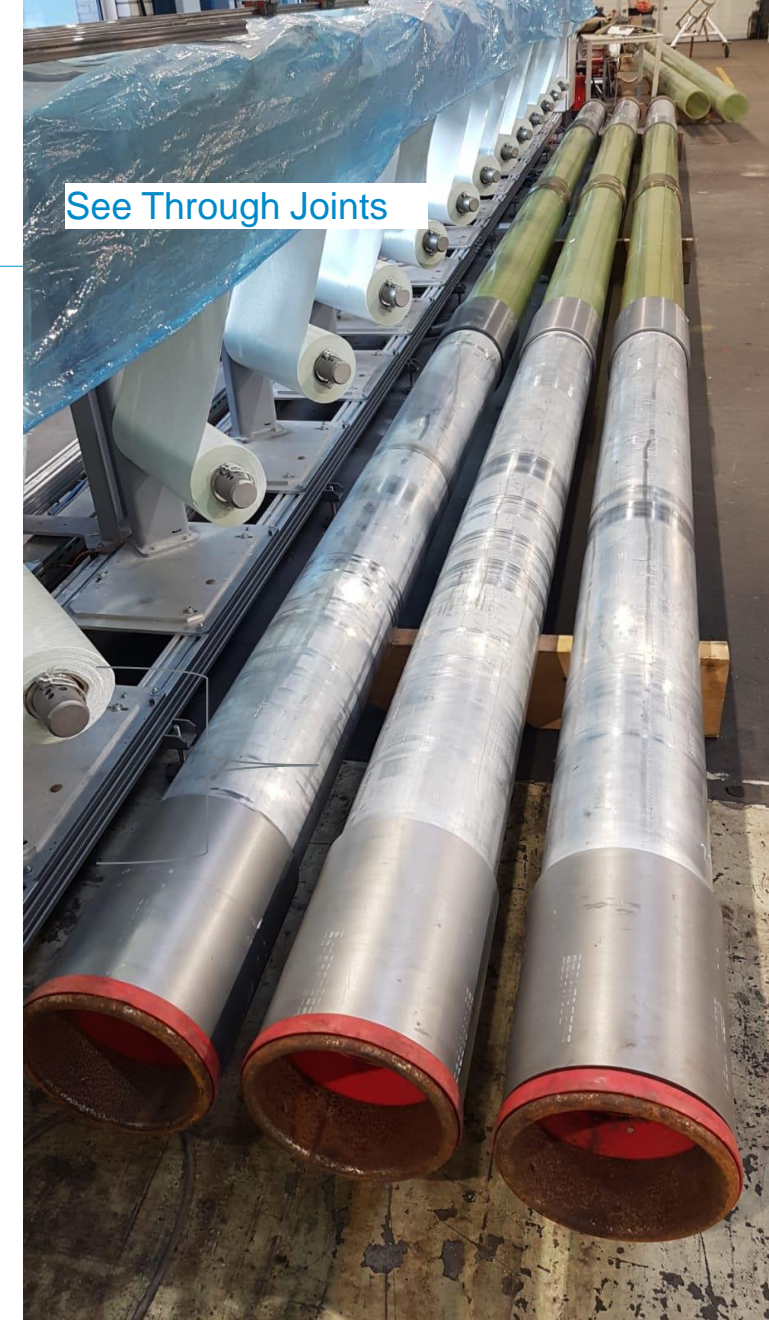
Bit



External String

Steel casing
Aluminum casing
Composite casing
Aluminum casing

Steel casing shoe



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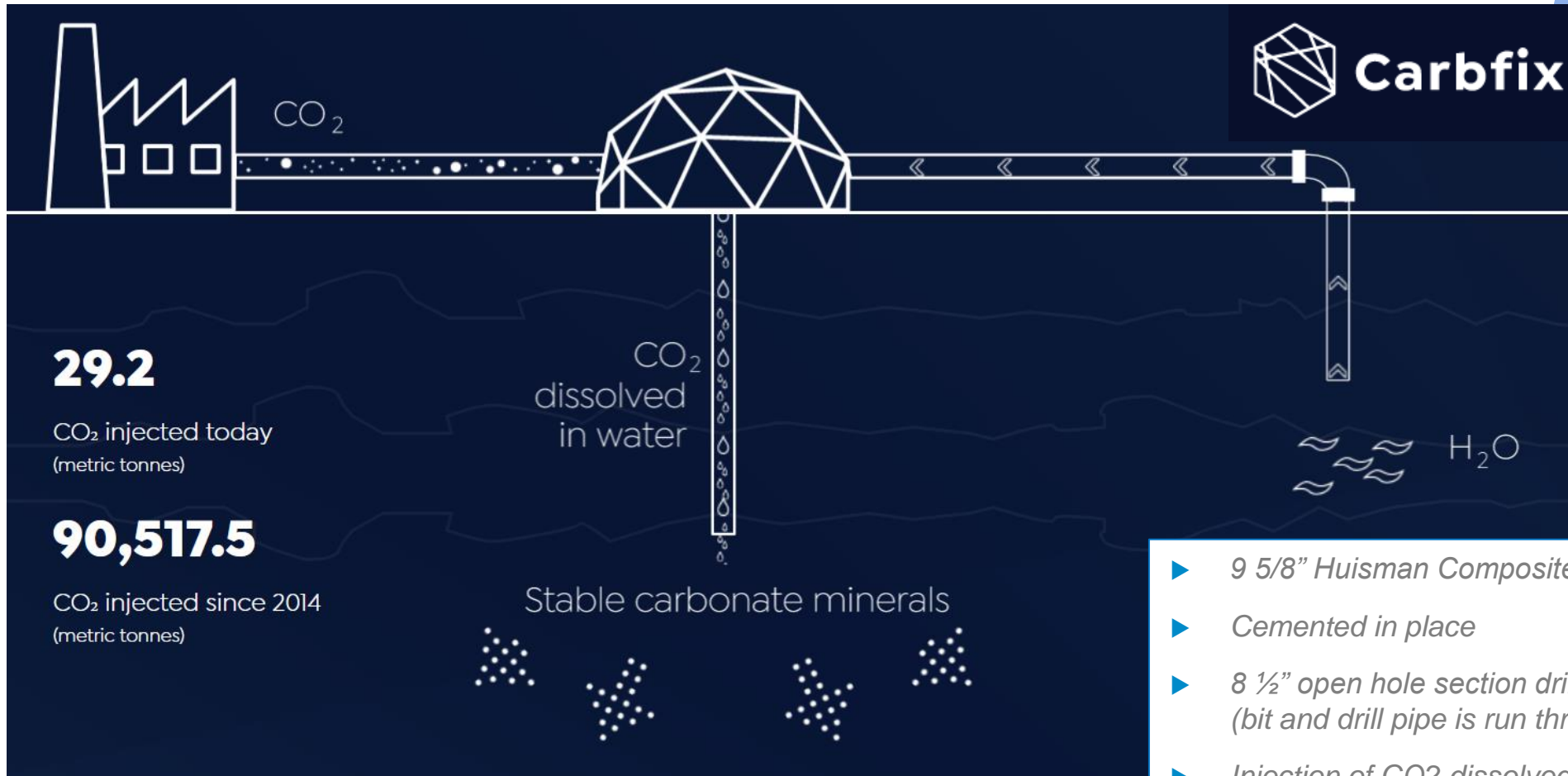
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APPLICATION: CASING – TEST WELL



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APPLICATION: CASING – CARBFIX CO₂ INJECTION WELL



- ▶ 9 5/8" Huisman Composite Tubulars casing run in 12 1/4" hole
- ▶ Cemented in place
- ▶ 8 1/2" open hole section drilled for well completion (bit and drill pipe is run through HCT)
- ▶ Injection of CO₂ dissolved in seawater

CARBON FOOTPRINT

SIGNIFICANT REDUCTION IN CO2 EMISSIONS COMPARED TO STEEL

Huisman Composite Tubulars					
Nominal size	7 5/8	9 5/8	10 3/4	13 3/8	
Weight class	24.1	34.0	43.7	65.7	kg/m
Emission	92	130	168	252	kg CO2-eq/m
	48%	44%	34%	25%	Less emission

Steel casing					
Nominal size	7 5/8	9 5/8	10 3/4	13 3/8	
Weight class	35.8	47.0	51.0	68.0	lb/ft
Weight	53.3	69.9	75.9	101.2	kg/m
Emission	178	234	253	338	kg CO2-eq/m
	93%	80%	51%	34%	More emission

And...

- Steel tubing might need 2 to 3 times replacement during the full well lifecycle, tripling the emissions for source material and adding extra emissions for workover activities.
- HCT will also reduce emissions during production due to lower pressure losses.



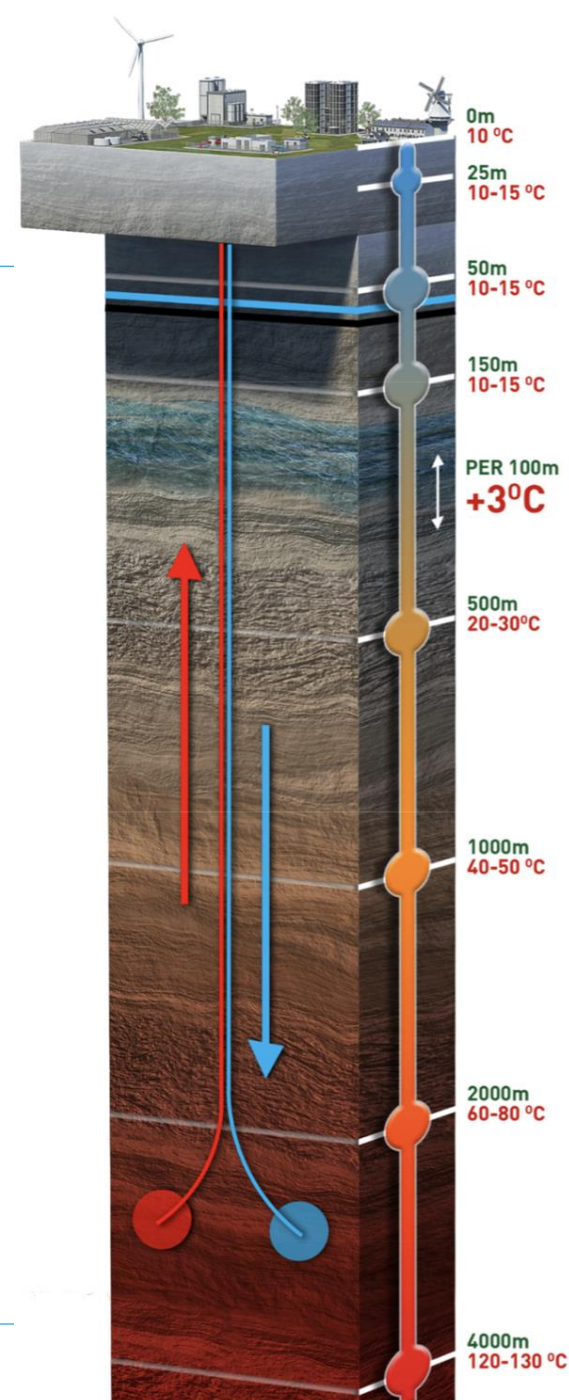
SAVING ON PUMP LOSSES

DRESSING NEW GEOTHERMAL DOUBLET WITH HCT

FEED STUDY: Protective Tubing string inside Producer and Injector

Tapered Tubing String (2015m A.H.):

- ▶ *Protective tubing string for inside 18 5/8" casing* HCT 13 3/8" (l=500m)
- ▶ *Protective tubing string for inside 13 3/8" casing* HCT 10 3/4" (l=970m)
- ▶ *Protective tubing string for inside 9 5/8" casing* HCT 7 5/8" (l=545m)

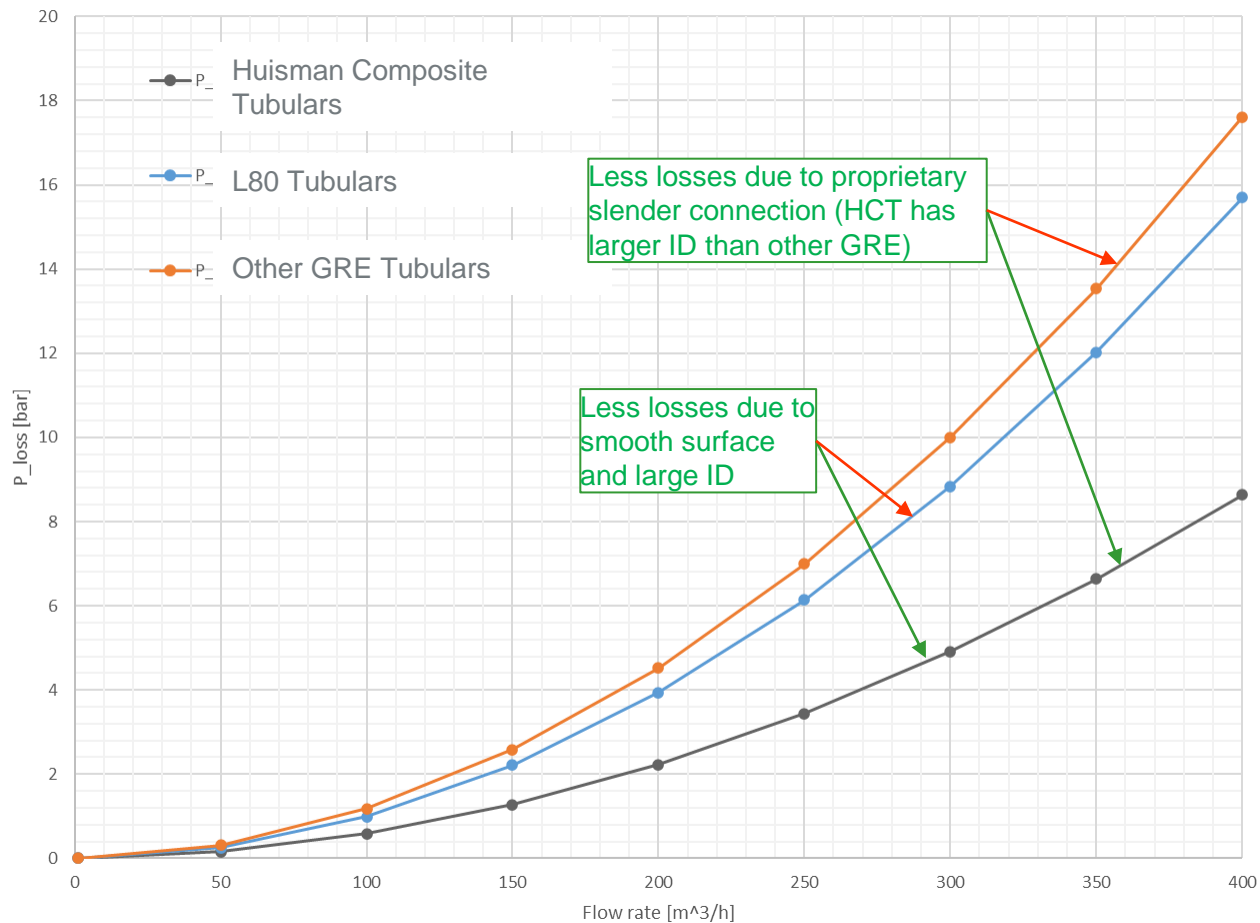


SAVING ON PUMP LOSSES

DRESSING NEW GEOTHERMAL DOUBLET WITH HCT

Pressure Losses

Pressure loss as function of Flow rate - Comparison



OPEX Savings for Doublet

- €180k/year on pump electricity (≈ €4,5Mio in 25y)
- €90k/year on inhibitors (≈ €2,2Mio in 25y)
- Reducing costly workovers (≈ 2,5Mio in 25y)
- In total, when choosing for HCT instead of steel, the operators saves ~ € 9.2Mio on OPEX over the lifetime of the doublet

Carbon Footprint



- ~25.000 tonnes less CO2 in 25y
(if pumps run on electricity from non-renewable resource)
- Extra CO2 savings due to fewer workovers and inhibitors

WINNER OF THE EUROPEAN GEOTHERMAL INNOVATION AWARD

“AN IMPORTANT PROGRESS TOWARDS UNLOCKING THE GEOTHERMAL DECADE” (MIKLOS ANTICS – EGEC PRESIDENT)



De 'Ruggero Bertani European Geothermal Innovation Award' wordt jaarlijks uitgereikt aan de organisatie die op het gebied van geothermie een belangrijke bijdrage heeft geleverd in de vorm van een innovatief product, wetenschappelijk onderzoek of projectinitiatief in het voorgaande jaar. De uitreiking van de award vond plaats tijdens GeoTHERM expo & congress op 2 en 3 maart 2023.



Source: Geothermie.nl

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