

The SCAN Geothermal Exploration Project – Results and Way Forward

Marten ter Borgh, SCAN Exploration Lead, EBN

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Shothole drilling for SCAN Seismic Lines





Take Home Messages

SCAN is a **geothermal exploration project** that will accelerate the development of **geothermal energy projects** in areas where little data is available, by:

→Acquiring over 1700 km of **new** 2D regional **seismic** lines (complete)

→Reprocessing of vintage seismic data (in progress, >3500 km complete)

→Drilling of data acquisition wells (in preparation)

Introduction to SCAN

- →SCAN is executed where insufficient subsurface data is available to make a reliable estimate of geothermal potential
- →Aimed at shallow and deep geothermal (500-4000m)
- →Provides a regional exploration dataset. For development of commercial projects more seismic and more local studies will generally be needed
- →Funded by the Ministry of Economic Affairs and Climate, executed by EBN and TNO.

SCAN focuses on the `white spots'. On this map they're actually coloured white, grey and light green

3D seismic and abundant well data available: <u>not</u> a `white spot`, <u>not</u> part of SCAN



Components of the SCAN programme

- 1. Acquisition of over 1700 km of new 2D seismic data
 - → Regional campaign commenced in September 2019, completed Q1 2022.
- 2. Reprocessing of over 7600 km of vintage 2D seismic data
 - → > 3500 km completed, rest will become available in batches until Q2 2023.
- 3. Data well campaign
 - → Spud of first well planned for Q3 2023

All results made public on <u>scanaardwarmte.nl</u> and <u>nlog.nl/scan</u>



SCAN project phases and activities



SCAN: Geothermal plays



→SCAN looks at a wide range of geothermal plays

→Focus on:

- →Deep and Shallow geothermal (500 m 4000 m)
- →Primary permeability
- Secondary permeability (from karst or leaching)

→<u>No</u> focus on:

- →Ultra Deep Geothermal (UDG; >4000 m)
- →Fracture / fault permeability
- Artificial/man made permeability systems (fracking, mine galleries, etc.)







SCAN Search Areas for Wells

| SCAN Search Area | Primary target | Secondary target(s) |
|------------------------|----------------|-------------------------------------|
| Amstelland | Rotliegend | Chalk, Rijnland |
| Utrecht | Rotliegend | Triassic, Rijnland, Chalk |
| Ede-Veenendaal | Rotliegend | Rijnland |
| Haarlem-Amsterdam-West | Rijnland | Schieland, Chalk |
| Oss | Triassic | Rijnland, Rotliegend, Chalk (Vaals) |
| Deurne | Triassic | Chalk (Vaals) |
| West-Brabant Noord | North Sea | None |

→ 7 Search Areas Announced
→ 3 More To Be Announced Early 2023

Search Area for Well

Rotliegend Play



Target: Rotliegend sandstones, deposited in a predominantly aeolian setting

Discussed in separate presentation on Amstelland search area

Producing projects and sufficient data in Northern part of Noord-Holland and Noordoostpolder; no SCAN well planned

Play will be tested on Zandvoort Ridge and Peel-Maasbommel Complex in search areas Utrecht-Oost, Amstelland, Ede-Veenendaal (primary target) and/or Oss (secondary target)

Triassic Plays



Target: Triassic sandstones (Nederweert Fm, Main Buntsandstein Subgp, Röt Fringe Sst Mb**)**

Triassic on Zandvoort Ridge tested in search area Utrecht-Oost

Triassic plays will be tested in search areas Oss and/or Deurne on Peel-Maasbommel Complex.

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Triassic plays: leaching

- Secondary porosity created by leaching may be an important mechanism for enhanced permeability
- →Occurs at basin edges where reservoirs are present below an unconformity (see highlighted points in map)
- →Untested concept around Peel-Maasbommel Complex and on both flanks of the Roer Valley Graben.





Rijnland Play



Target: Rijnland Group sandstones (Vlieland Sst equivalent)

Discussed in separate presentation on Amstelland search area

Play will be tested in search area Haarlem-Amsterdam West as a primary target, and in Amstelland, Utrecht-Oost, Oss and/or Ede-Veenendaal, as a secondary target

Lower North Sea Group - Brussels Play



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Data-acquisition in SCAN wells

Extensive data acquisition is planned in SCAN wells. Generic programme shown. Detailed programme to be determined per well.

→ Cores

- → Reservoirs: Porosity/permeability data
- → Reservoirs: Sedimentology and diagenesis (incl. descriptions and thin sections)
- → Geomechanical tests (note: also possible for <u>non</u>-reservoir)
- → Production / injection test(s)
 - ➔ Flow rate and transmissivity
 - ➔ Temperature, pressure and water composition
- → Well Logs, both reservoirs and overburden
 - → Gamma Ray, Sonic (Vp/Vs), density/neutron, resistivity (whole well)
 - → Image logs (for sedimentology and diagenesis, fractures and stress directions)
 - → NMR log (for permeability)
 - → Temperature
- → Vertical Seismic Profile (for robust correlation onto regional seismic grid)
- → XLOT (eXtended Leak-Off Test)
 - ightarrow Determination of caprock integrity
- → Cuttings and biostratigraphy
 - → Vitrinite reflectance, apatite fission track, ...
 - ➔ Dating and correlation of relevant intervals



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Daalsesingel 1 3511 SV Utrecht info@scanaardwarmte.nl www.scanaardwarmte.nl nlog.nl/scan

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