



Expansion of deep geothermal energy in the Netherlands

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ebn

Overview

- EBN and the energy transition
- Geothermal energy in the Netherlands
- SCAN & UDG
- Outlook & conclusions



Ministerie van Economische Zaken
en Klimaat



> Our Dutch Gas



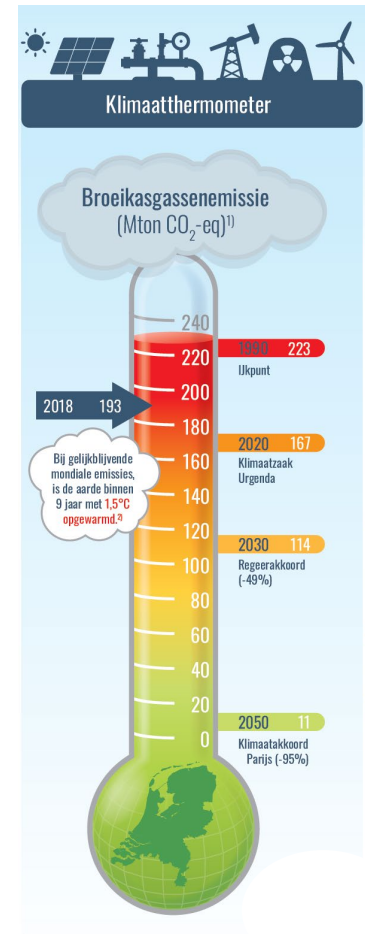
> Return to Nature



> New Energy

Social task and goals

- Climate neutral energy supply in 2050
- Energy systems need to be renewable and sustainable
- Multiple options to get to a sustainable heat supply to residential areas
- Geothermal energy could be a large player
- Expand, investigate and invest



Geothermal heat in the energy transition

- Policy letter from ministry of economical affairs and climate: geothermal sector needs to be strengthened and accelerated (EBN)
- Strengthen:
 - Fit-for-purpose regulation (not one-size-fits-all based on gas and oil)
 - Financial participation by EBN
- Accelerate
 - Exploration of the subsurface (SCAN & UDG)
 - Innovation Roadmap



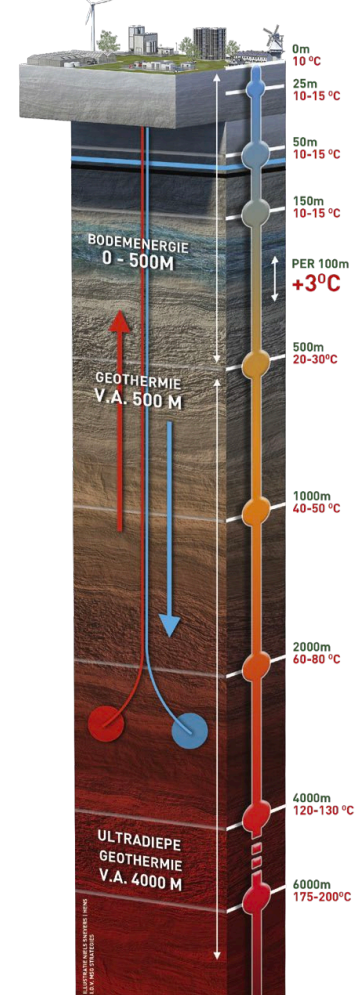
Geothermal energy in NL

- Deeper than 500m
 - Shallow geothermal: down to ~1200m
 - Ultra-deep geothermal: deeper than ~4000m
- Current geothermal projects in NL > 2000-3000m

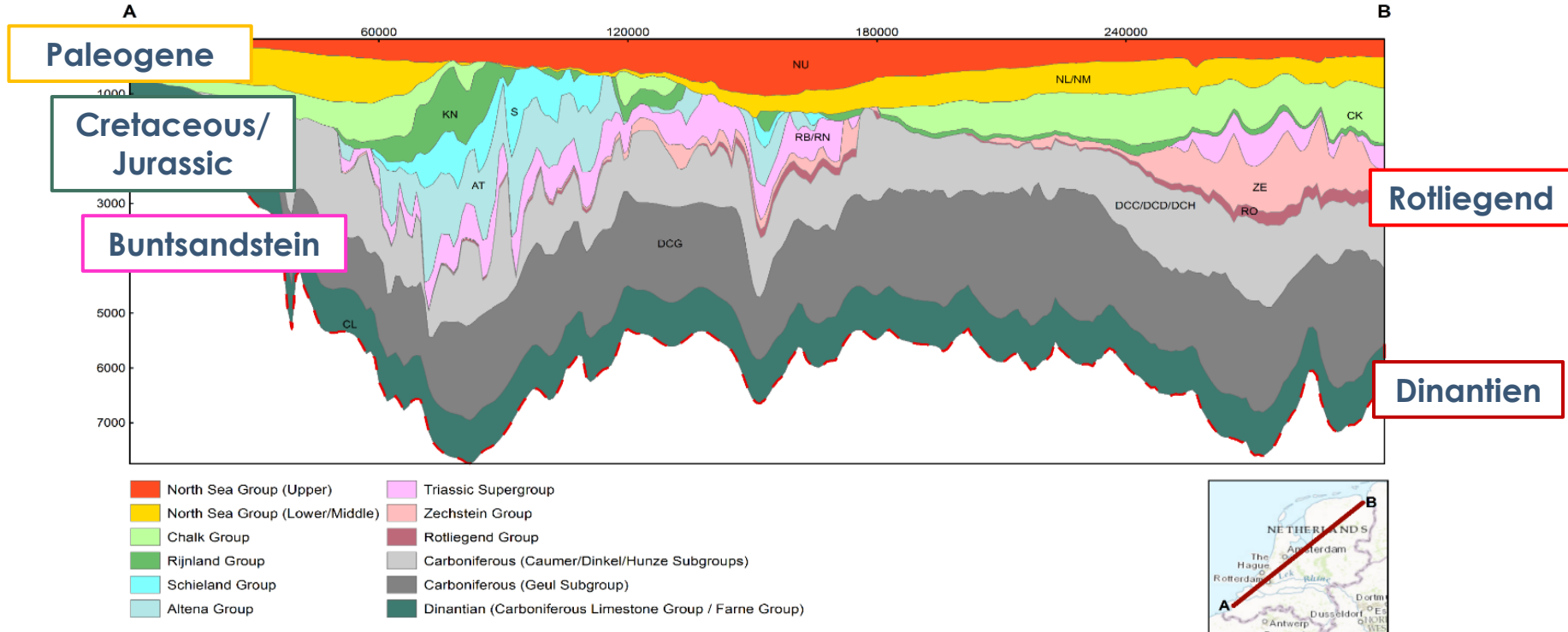
Temperature increases by $\pm 30\text{ }^{\circ}\text{C}$ per km depth.

2 km: $\pm 70\text{ }^{\circ}\text{C}$

3 km: $\pm 100\text{ }^{\circ}\text{C}$

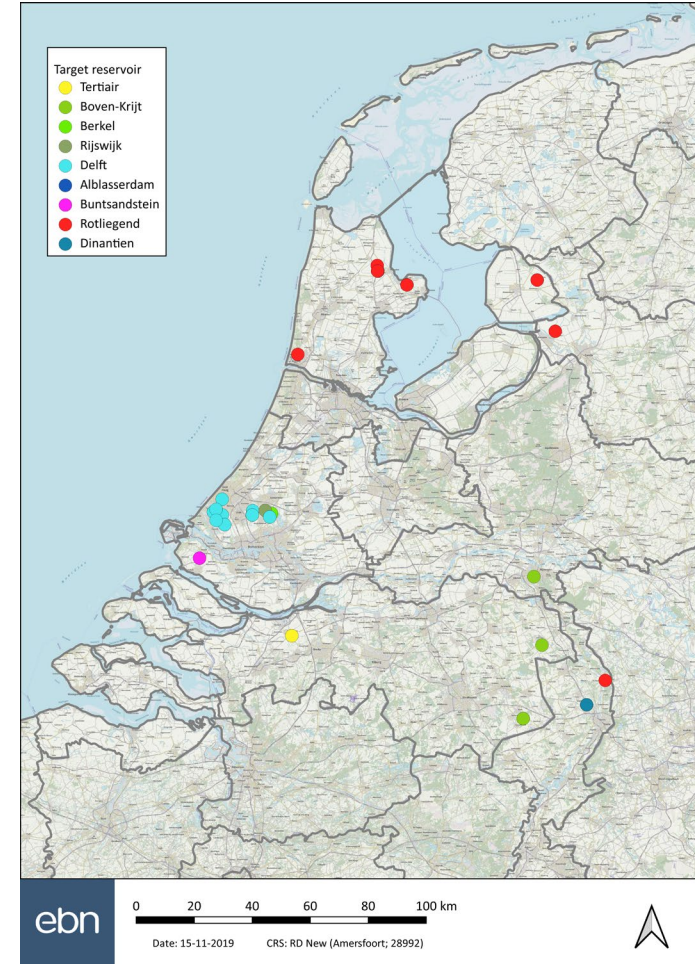


Geothermal aquifers in the Dutch subsurface



Geothermal heat in the Netherlands

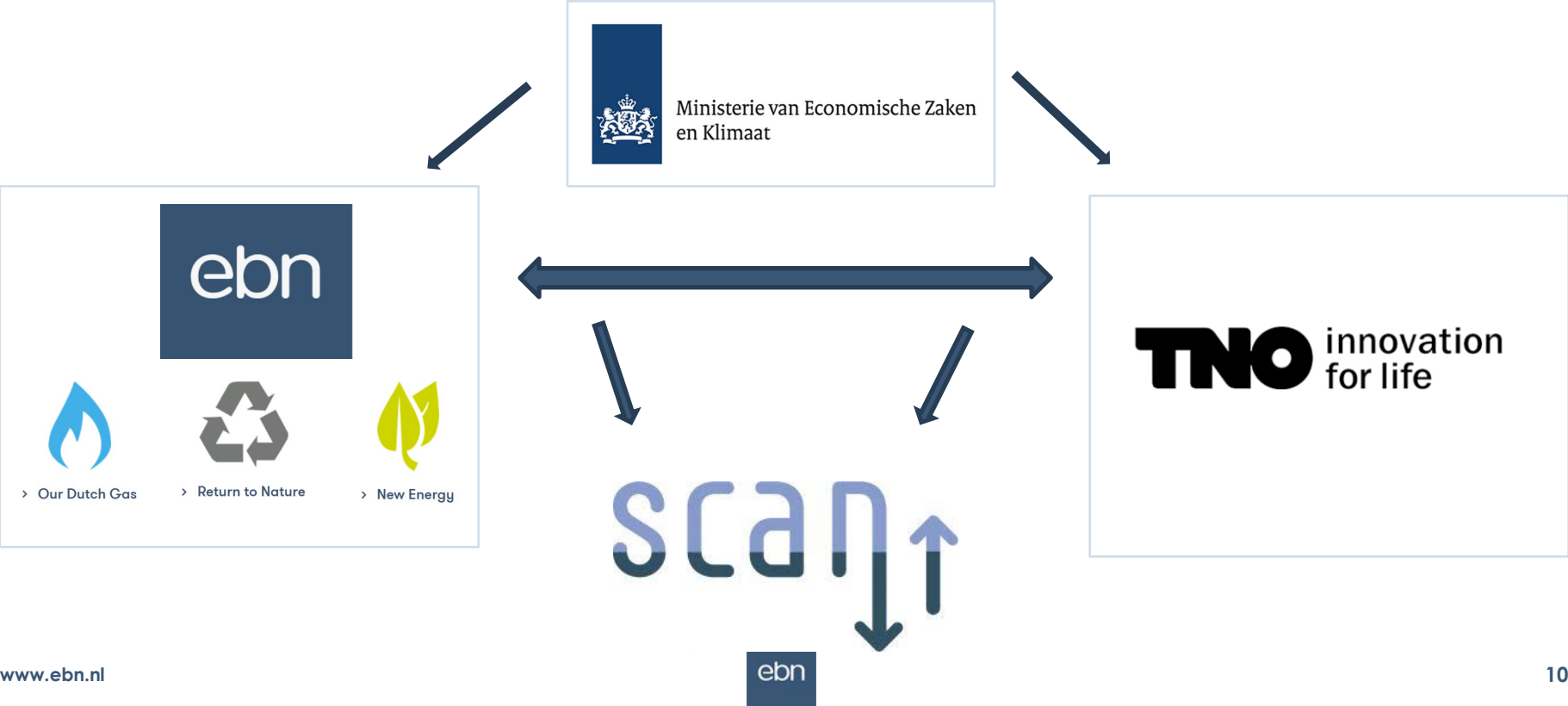
- ~ 55 geothermal wells
- ~21 geothermal projects, mainly in the horticultural sector / greenhouses
- geothermal energy is now a proven sustainable heat source for the horticultural sector
- 1 project ready for heat supply to residential area; multiple projects gearing towards heat supply to residential areas
- Geothermal potential NL still not completely known



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Organisation SCAN-program



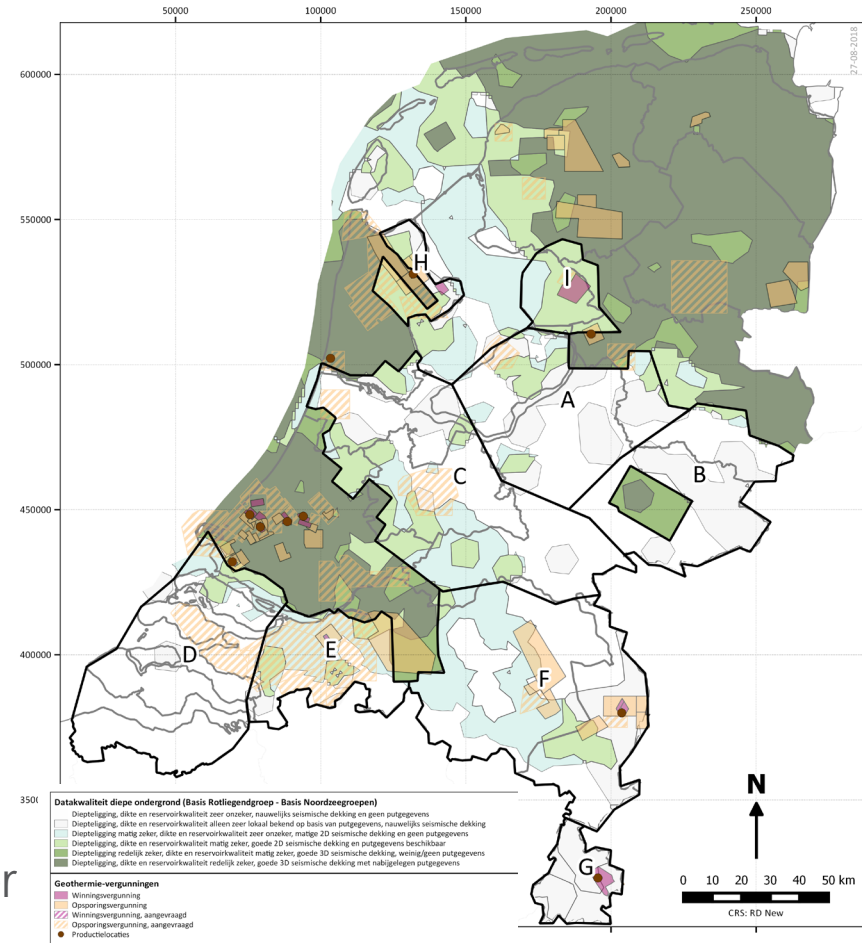
'Colouring the white areas': SCAN

White area: insufficient subsurface data

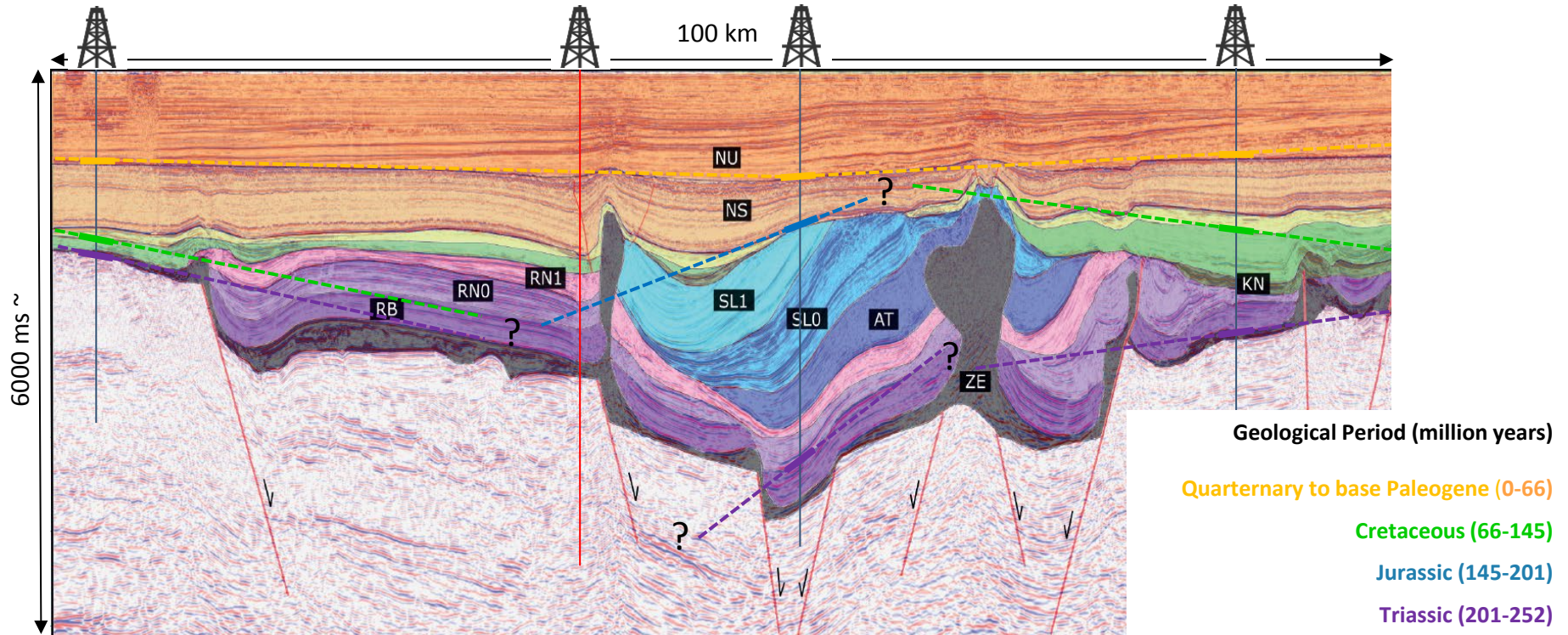
- Reprocess existing seismic data
- Acquire new seismic data
- Data acquisitions wells?

All data publicly available

- Looks at all plays / geological layers
- Provides input for the exploration on Ultra Deep Geothermal Energy (UDG)
- Provides input for the DGE-Rollout under Interreg



Importance of seismic data



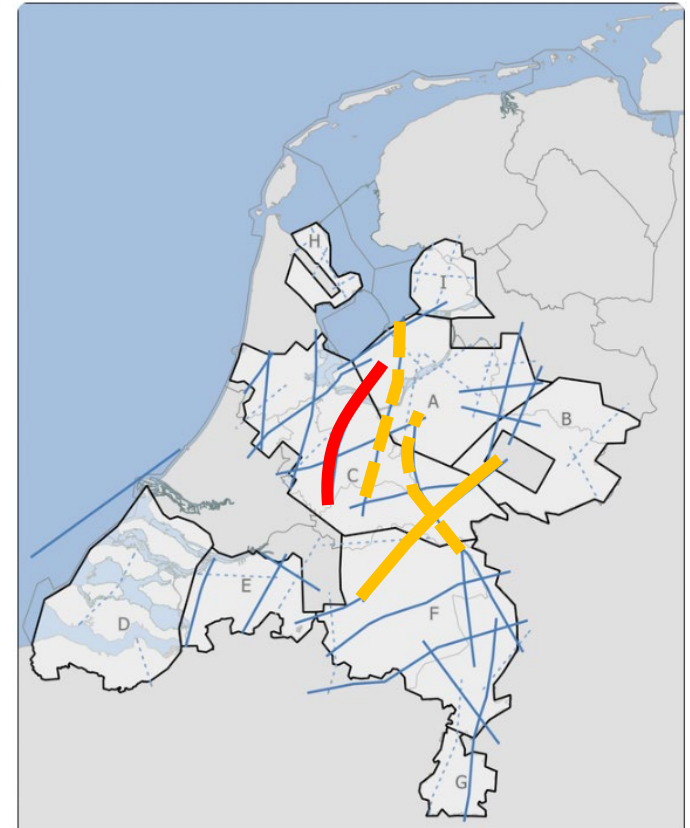
Fugro, 2015

www.ebn.nl

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SCAN seismic campaign

- Test-line Q1 2019
- Start main campaign Q3 2019
- Main campaign until Q3 2021
- Explosives



scan ↑

SCAN lijnenplan

0 20 40 60 80 100 km

Datum: 31-10-2019 CRS: RD New (Amersfoort; 28992)

SCAN lijnen
— Basis
- - - Optioneel
□ Provincies
▭ SCAN gebieden

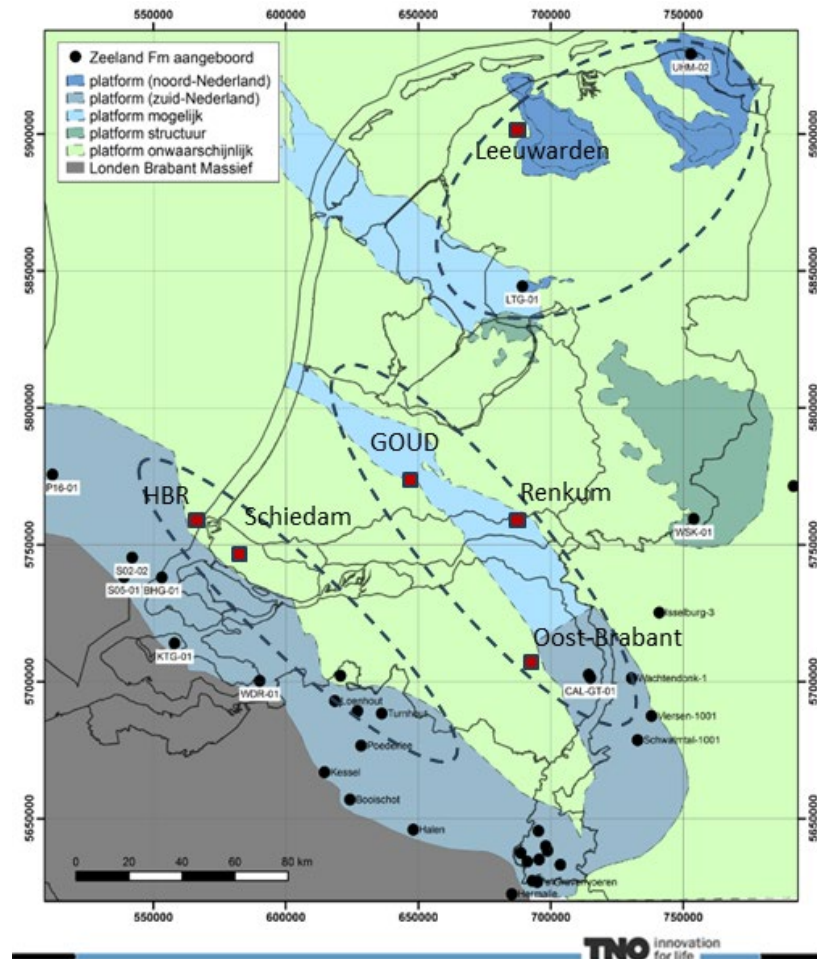
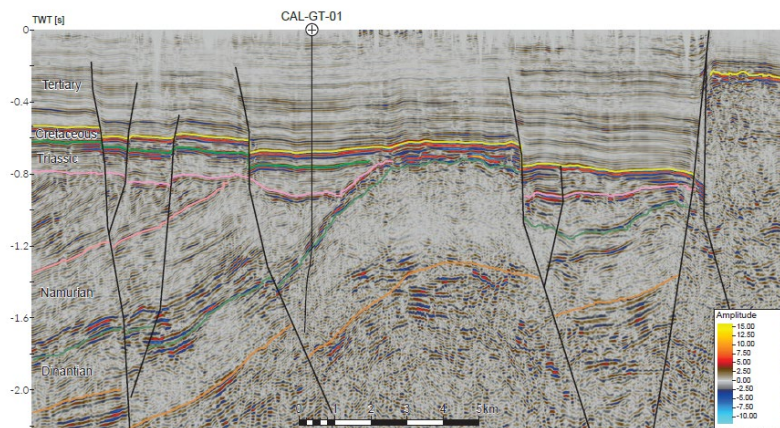
Ultra Deep Geothermal Program

to assess high temperature geothermal potential of Dinantian Carbonates

- **Green Deal UDG** - EBN, TNO, Ministries and 6 industry corporate consortia to utilize synergies and lower risks
- **Program**
 - **Technical play-based** - seismic, facies and diagenesis, petrophysics, static & dynamic reservoir models, temperature gradients, stress & seismicity, conceptual well and stimulation design, risk analyses
 - **Non-technical program** - business cases, stake holder management, communication, heat demand and surface system integration, financing
- Activities should result in identification of 1-3 pilot UDG projects
- Duration 3 years, ~25 FTE, € 28 million.
- Strong government support

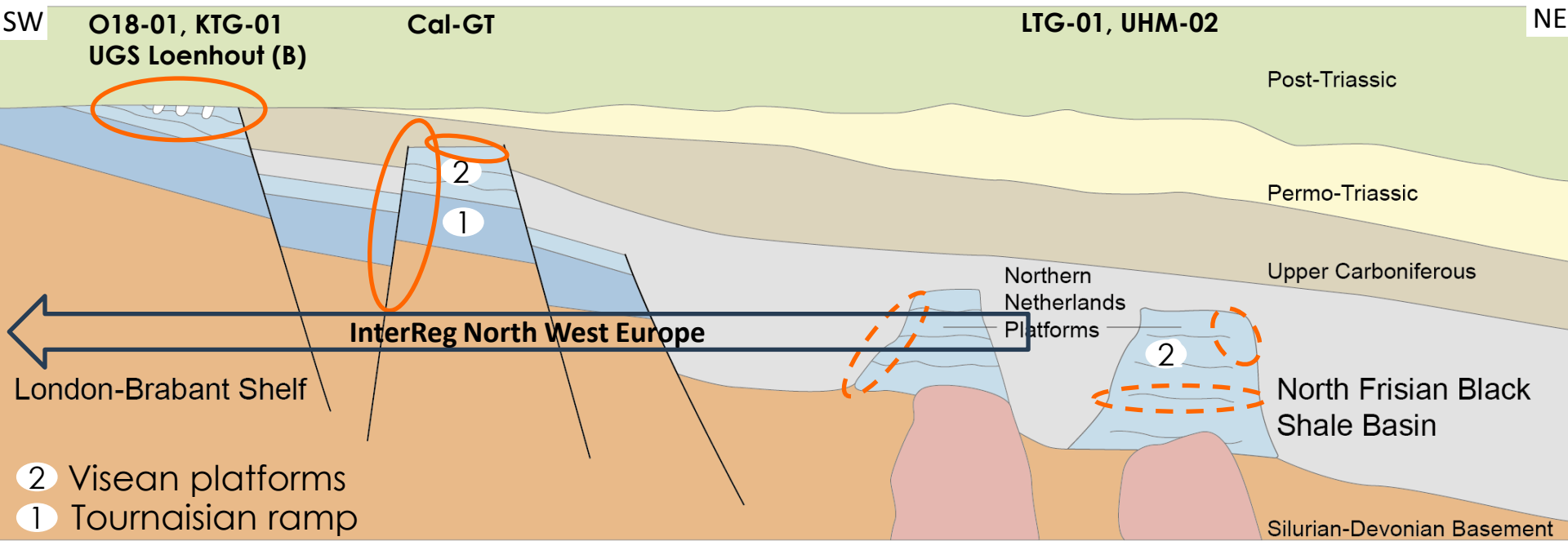


SCAN Dinantien





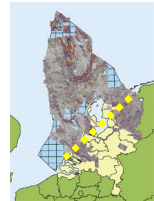
Dinantian Carbonates are heterogeneous

Differences: dimensions, shape, facies, diagenesis, fractures, Z / T / P, stress etc.



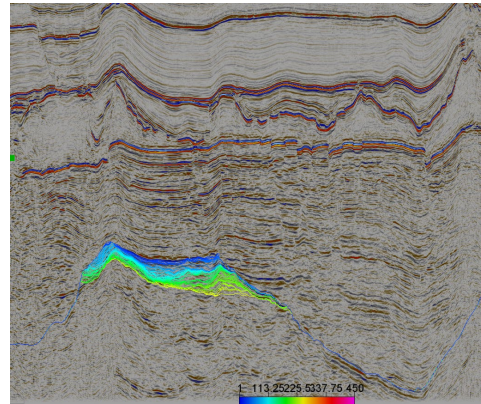
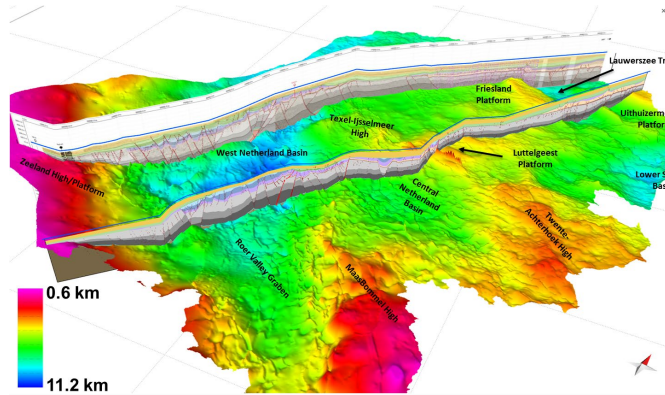
- 2 Visean platforms
- 1 Tournaisian ramp

-  Karst and/or fracture scenarios - from well and seismic data and analogues
-  Karst and/or fracture scenarios - from analogues

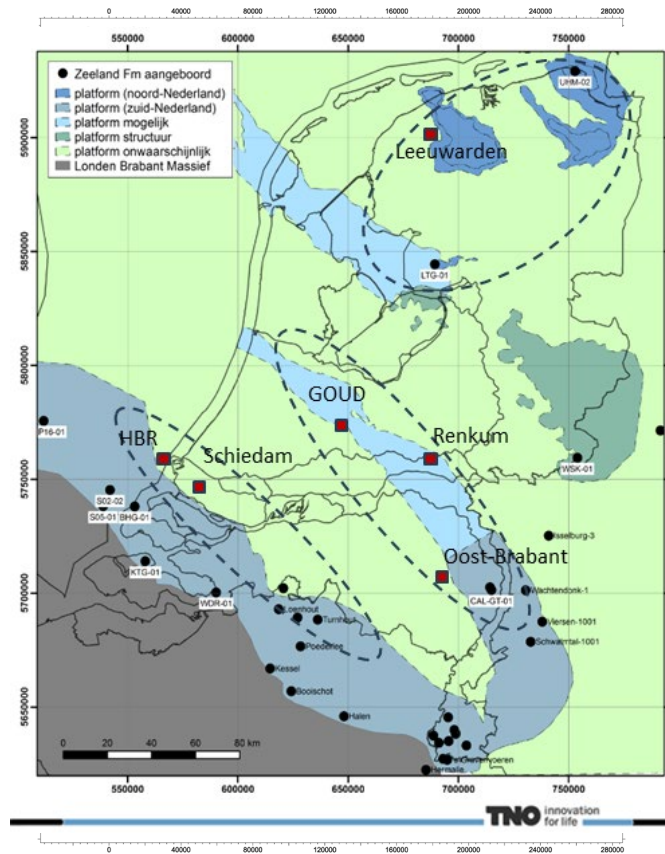


SCAN Dinantien

- Seismic interpretation & depth conversion
- Burial and structuration analysis
- Facies distribution & diagenesis

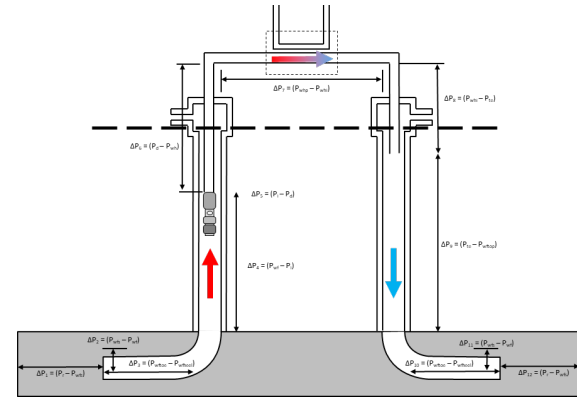
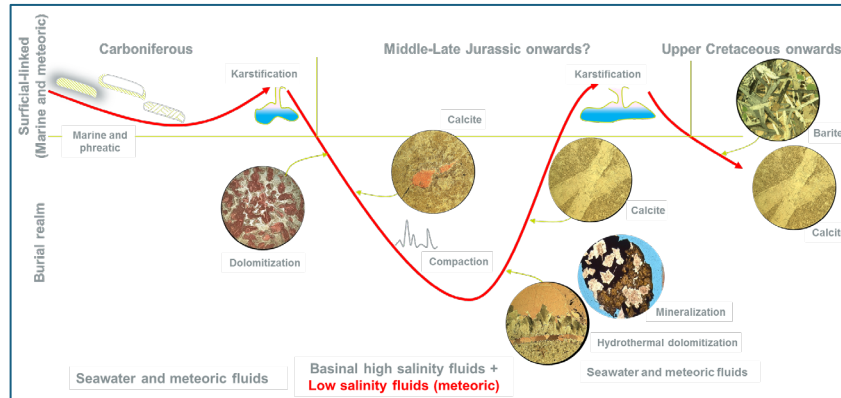
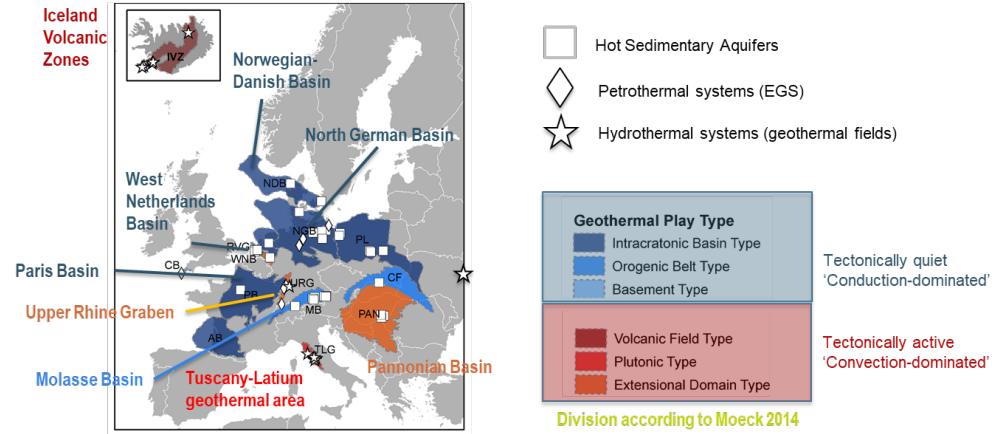


Moliniacian-Livian (Sequence 2) and Warnantian (Sequence 3) facies distribution



SCAN Dinantien

- Petrophysical evaluation
- Seismicity
- Productivity and injectivity
- Hazard register UDG wells



Conclusion

- Geothermal energy is important for the Dutch transition to renewable heat
- The Dutch government is ambitious, supporting programs such as SCAN and UDG
- The SCAN program is 'colouring the white spots': targeting all geological plays
- The Green Deal Ultra Deep program is set up to assess the (high temperature) geothermal potential of the Dinantian Carbonates in the Netherlands
- Current large spread in predicted power makes it difficult to estimate the economic potential of UDG, more data is needed, and more financial resources
- The energy transition requires the public and private sector to actively work together, thereby relying on support of the Dutch people as well

Thanks

Bastiaan Jaarsma

Timme van Melle

The logo consists of the lowercase letters 'ebn' in a white, sans-serif font, centered within a solid dark blue square.

ebn

energising
the transition