



Een duurzame **warmtetransitie**

Geothermal potential of the Alblasserdam Fm

Introduction and recap

Geothermal production

Geothermal potential

Future production?

Unlocking the potential

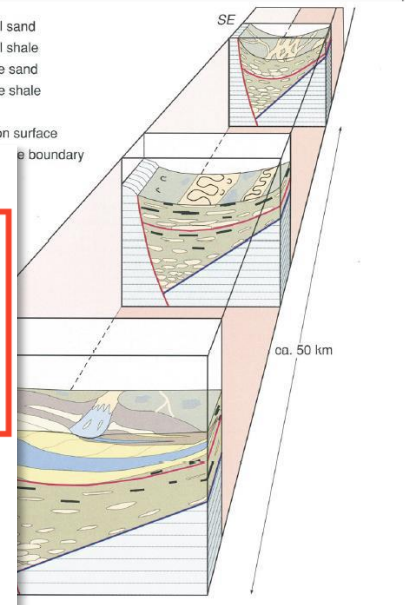
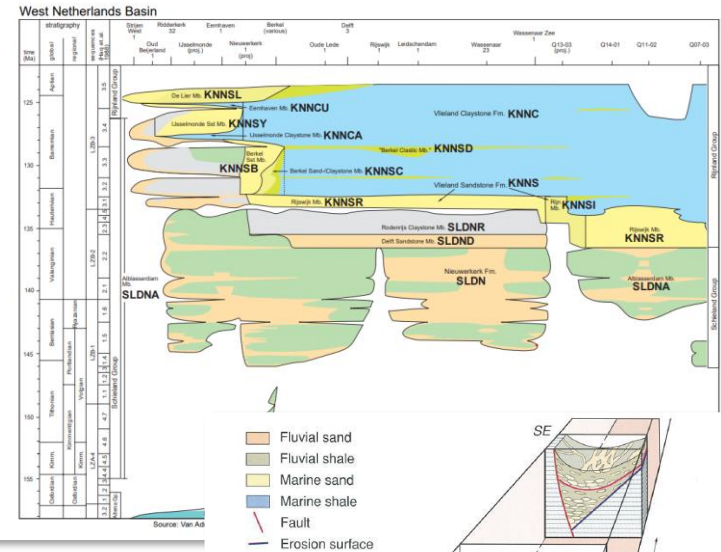
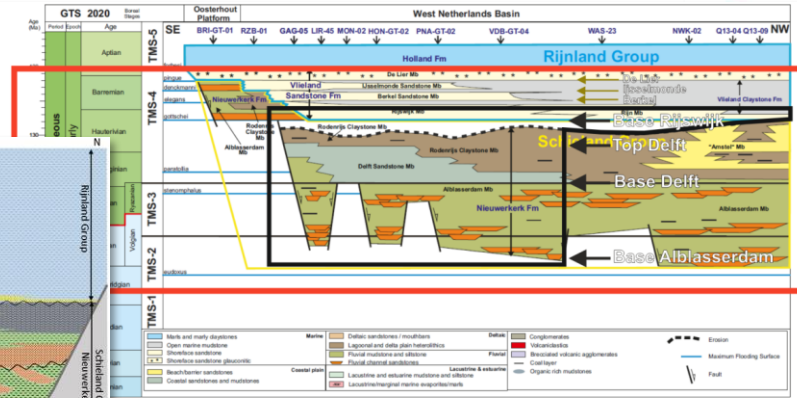
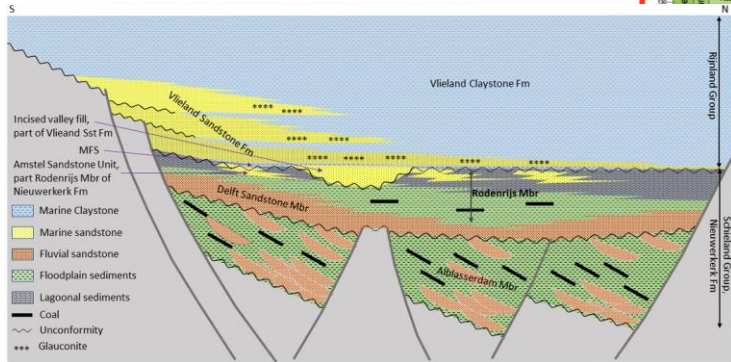
Conclusions



Introduction and recap

Alblasserdam Fm

- Widespread presence in the WNB
- Half-grabens
- Terrestrial (fluvial) / sheets, isolated & amalgamated channels
- Heterogenous
- Low NTG
- Clay and siltstone, fine - medium grained sandstone beds of a few meters thick, and massive, thick-bedded, coarse grained sandstone
- Thickness: 0 – 1500m
- Stratigraphy / Nieuwerkerk Fm
- Geothermal potential studies



Interest (AOI) and Stratigraphic Interval of Interest (SIO) of the West Netherlands Basin for the GEO-BFBWNB Project

Interest (AOI) and Stratigraphic Interval of Interest (SIO) for the Delft-Alblasserdam Project (TNO 2023)

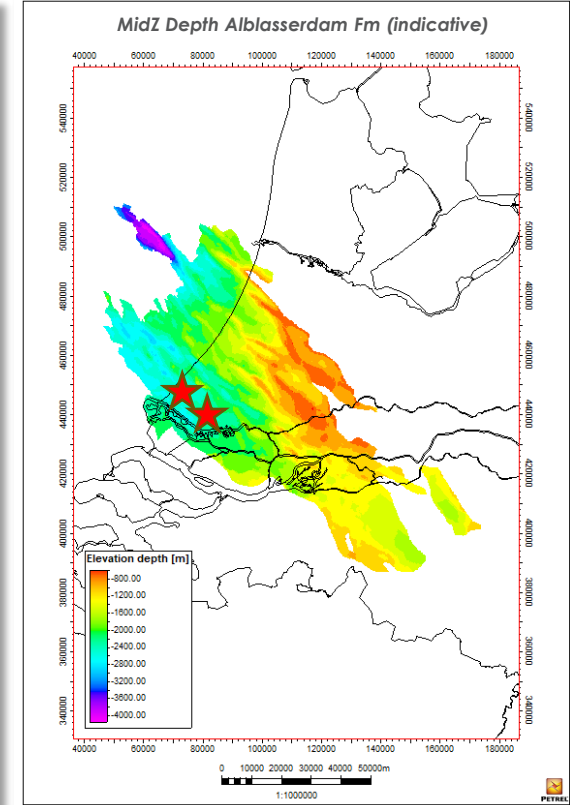
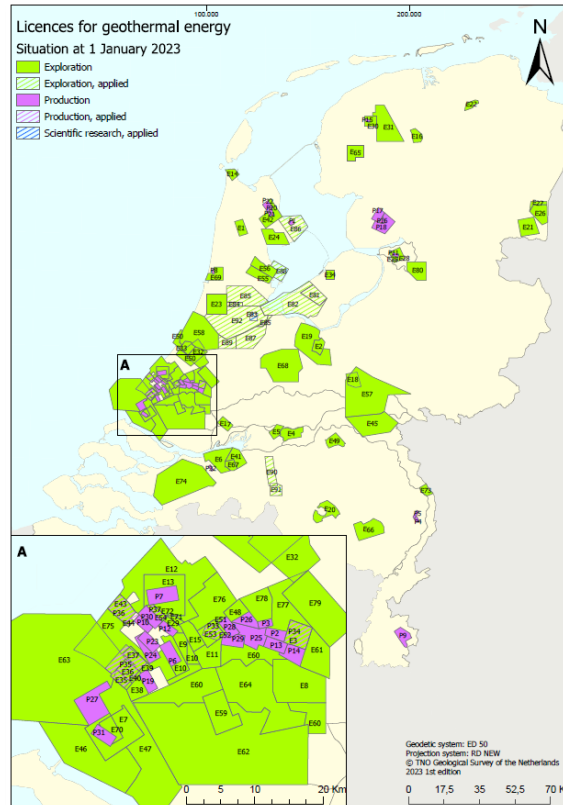
ic horizons interpreted and integrated from previous work (AGE, Geomodelling) in the Delft-Alblasserdam Project (TNO2023)

ic horizons interpreted (no coverage of whole research area) during intra-TNO Vileland Sandstone project (TNO2021)

Geothermal production

Quick overview

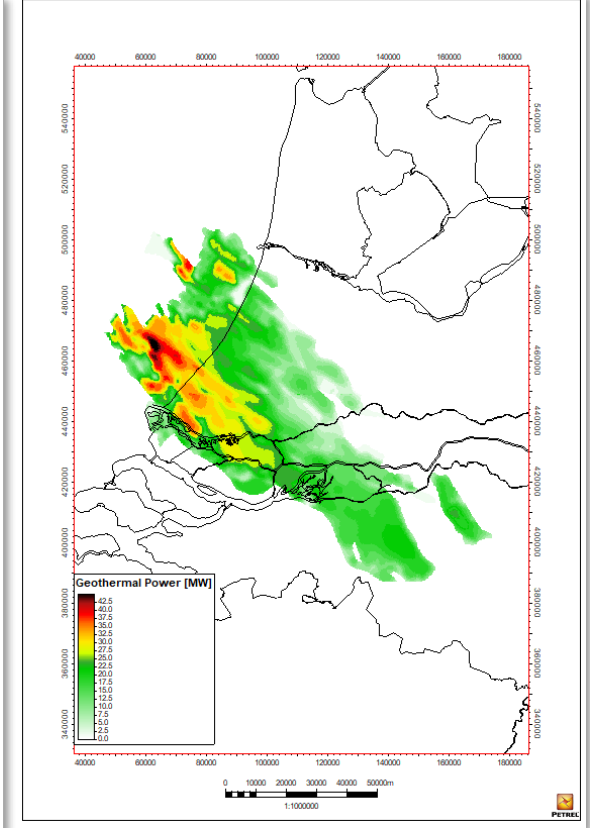
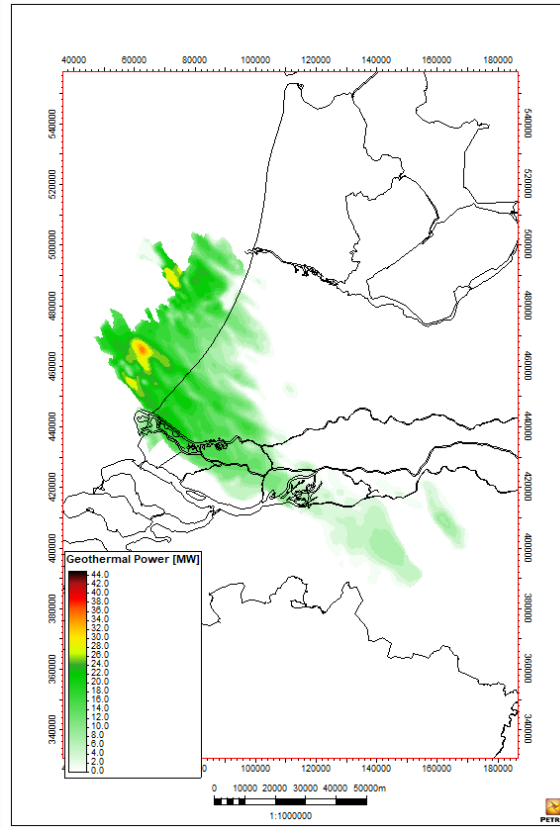
- Restricted to West Netherlands Basin / Roer Valley Graben
- Drilled many times by geothermal wells, rarely whole section
- “Proper” production in the south-west edge
- Reduced Delft Sandstone Fm or absence



Geothermal potential

Base case

- Power calculation
 - Actual thickness
 - NTG ~ 0.5
 - Porosity vs depth relationship
 - 12-27% (~19%)
 - Permeability of net sands:
 - 200-600mD (~400mD)
 - Max. BHP allowed
 - Penalty of -1 bar above $\Delta T = 40$
 - Max flow @ 500 m³/hr
 - Currently ! 360-400m³ (ESP limits)
 - $T_{\text{injection}} = 10 / 25 / 50 \text{ degC}$

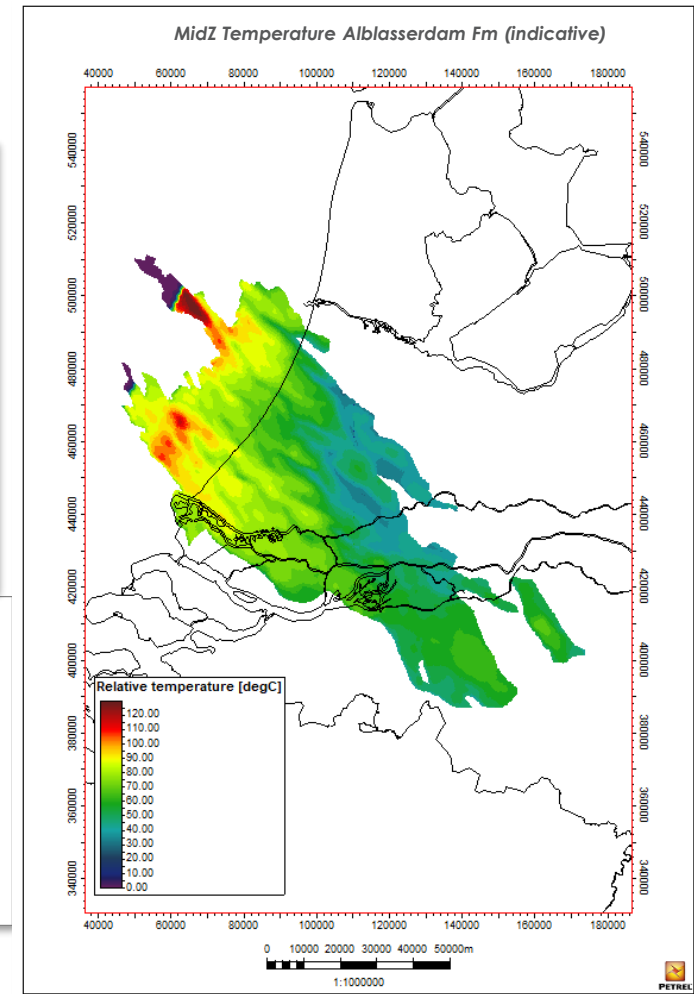
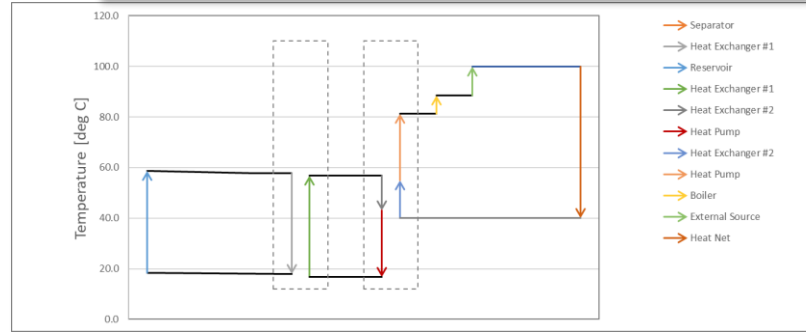
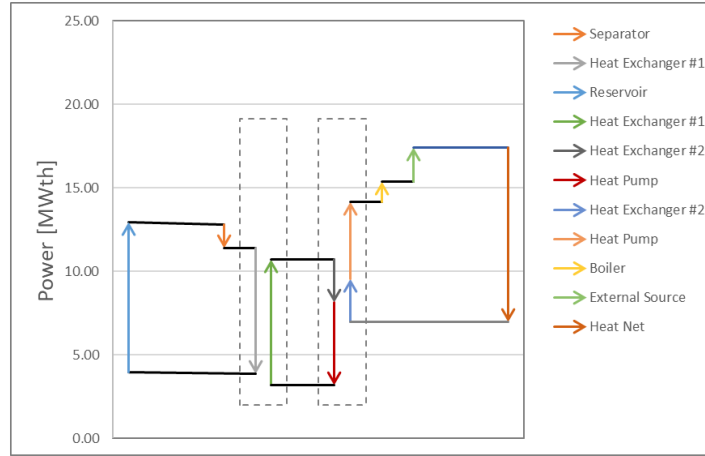


Geothermal potential

Temperature

Heat distribution NW:

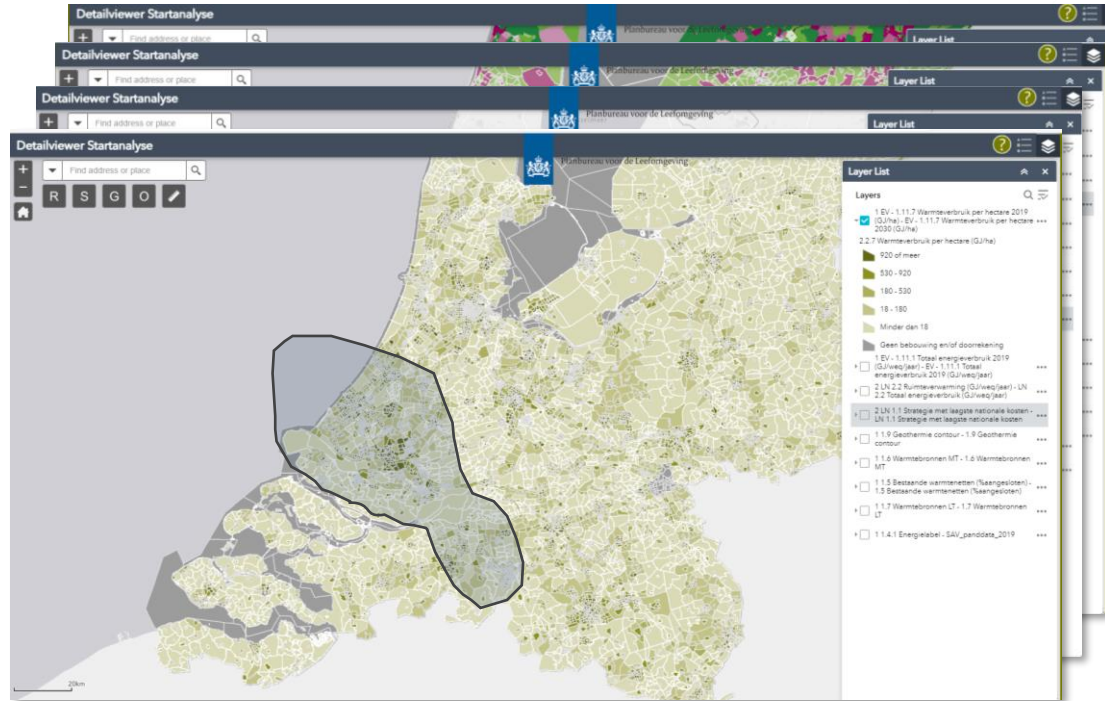
- ZHT >90 degC
- HT 90-70 degC
- MT 70-40 degC
- LT 55/50-20 degC



Geothermal potential

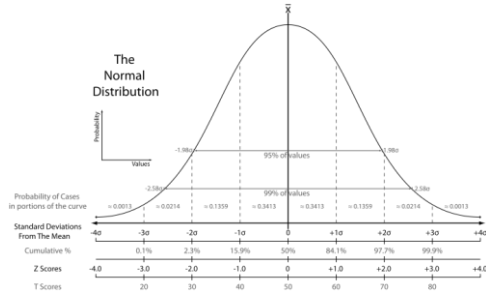
Heat demand & supply

- Location near urban areas
 - Heat demand high
 - Room heating
 - HT & MT & LT demand
 - Current strategies also on green gas / hydrogen
 - Heat distribution networks available but far from widespread
-
- Example heat demand vs supply
 - 1 project @ 1500 m TVD incl. heatpump
 - 14 – 20 MW (7.5-12 MWth / 250-500md)
 - @ 4000 hrs: ~ 0.20/0.29 PJ
 - @ 8000 hr: ~ 0.40/0.58 PJ
 - 200000-290000 GJ
 - 920 GJ/ha → 217 – 315 ha / 2.17 – 3.15 km²
 - 530 GJ/ha → 377 – 547 ha / 3.77 – 5.47 km²
 - 180 GJ/ha → 1111 – 1611 ha / 11.1 – 16.1 km²
 - Eindhoven: 88 km²
 - Waalwijk 21 km²

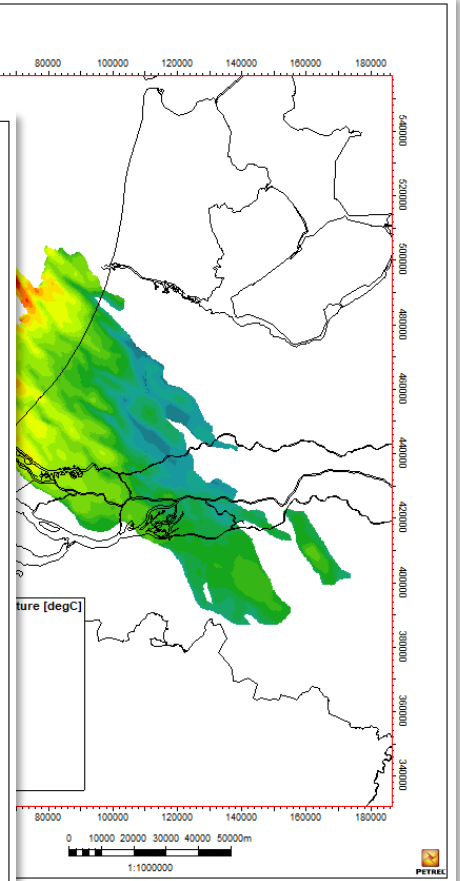
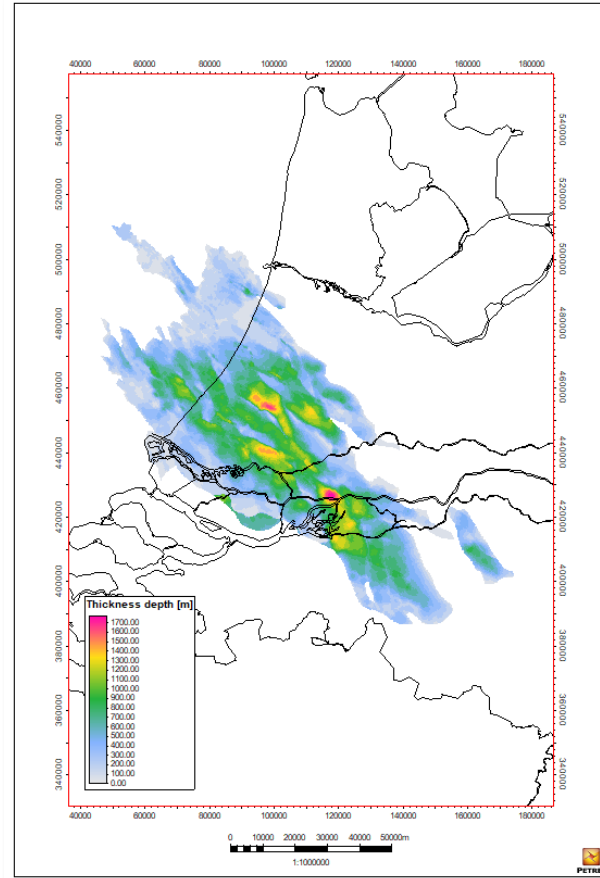


Future production?

Challenges



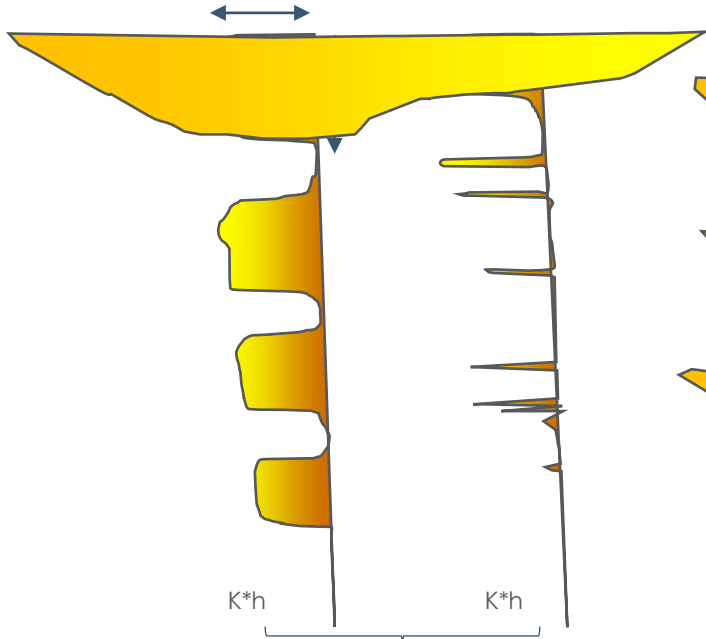
$$GPOS = P_{aq} \cdot P_{perm} \cdot P_{fluid} \cdot P_{temp} \cdot P_{con}$$



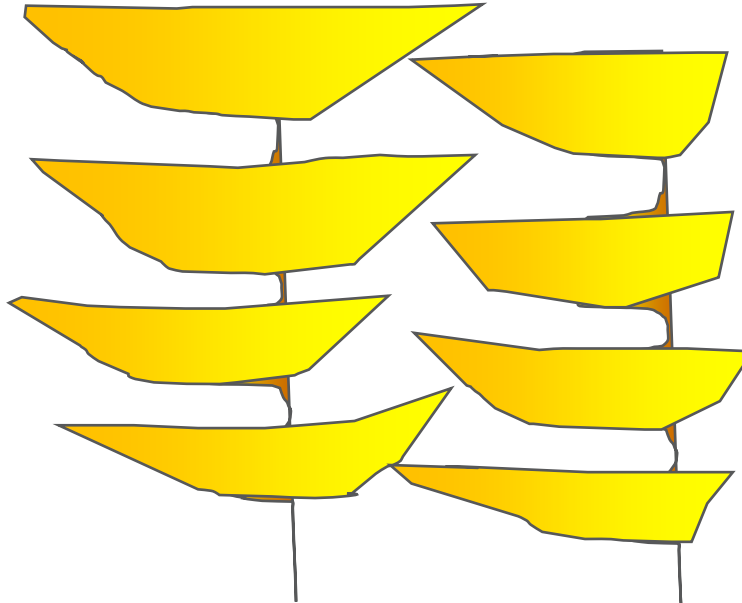
Een duurzame **warmte**transitie

Future production

Challenges



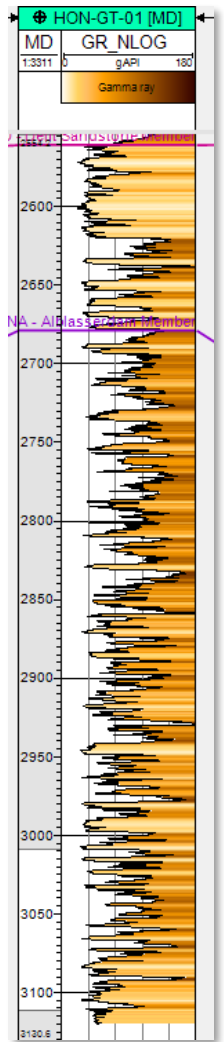
6 Dm & 1Dm ~ 3,5Dm
→ 1 Dm



6 Dm & 6 Dm ~ 6 Dm
→ 6 Dm but no connectivity



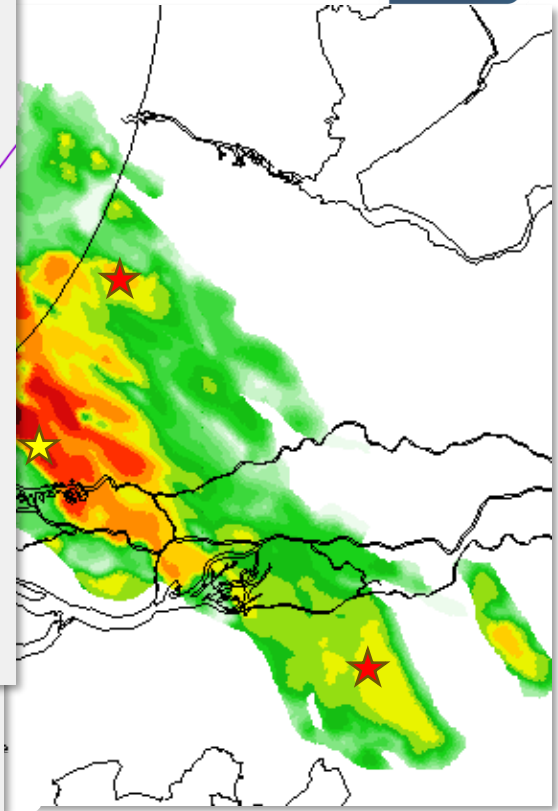
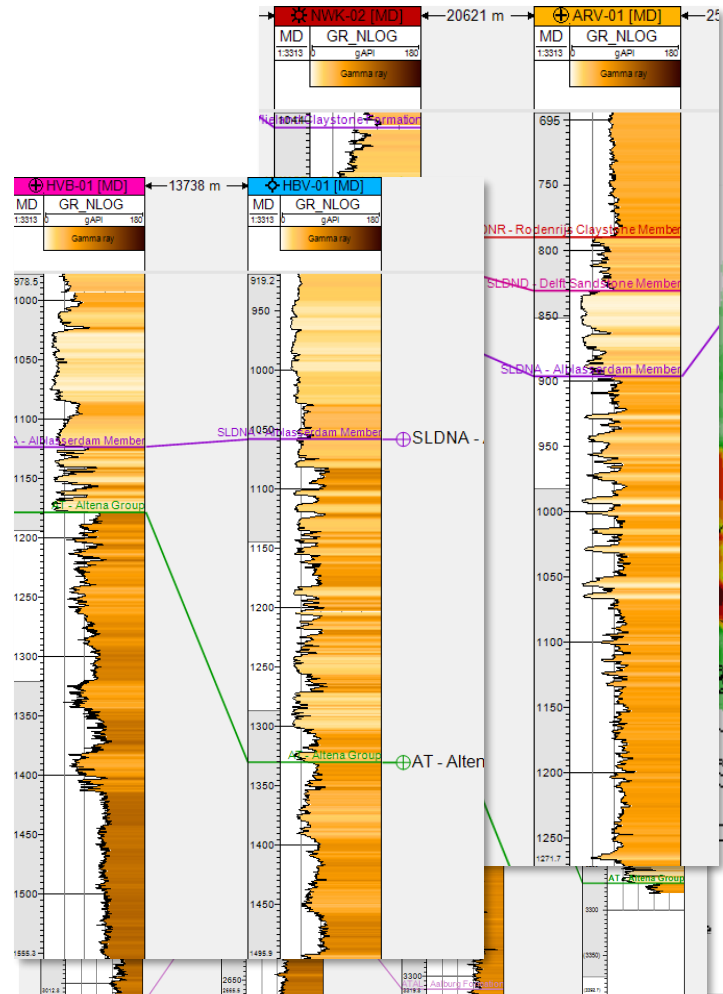
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Opportunities

Development

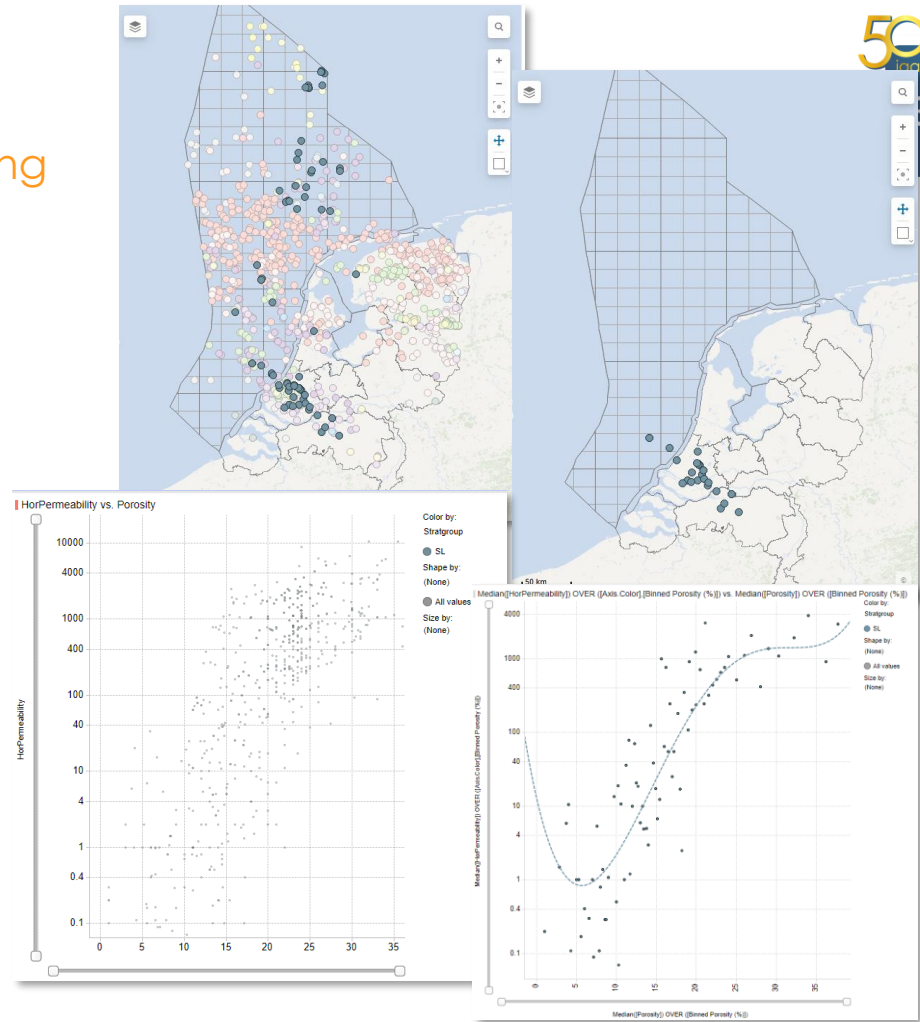
- South-West WNB extended
- WNB deep
- Rijnland licence area
- Brabant
- ...



Unlocking the potential

Data acquisition, studies & engineering

- Reduce data-gap
 - Data acquisition
 - *Upside: 3D seismic*
- Increase knowledge-gap
 - Desktop studies & research
- Invest in concept select
 - Target lower temperatures
 - Heat pumps
 - Heat storage?
 - Different completion techniques?
 - Inflow control devices
 - Horizontal (kv/kh!)
 -



Conclusions

- More and more information is available about the characteristics & presence of the Alblasserdam Fm.
- Integrated and consisting concepts are being developed
- Ongoing information supply from:
 - Well data from operators
 - Geological studies
 - Geophysical studies
- Need for regional and local understanding of presence, connectivity (NTG) & permeability necessary
- Geothermal is stepping away from HT; geothermal potential of the Alblasserdam Fm as low to mid-temperature heat source increases
- Possible need for better completion techniques



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jaar

ebn

Thank you for your attention

- Practical side
 - Potentieel Alblasterdam tegenover ander potentieel WNB
 - Producibility
 - Temperature
 - Field development
 - Exploration
 - Opportunities
 - Rijnland
 - Alphen?
 - Brabant



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Geology of the West Netherlands Basin 'a geothermal hotspot'

SYMPOSIUM

14th of March

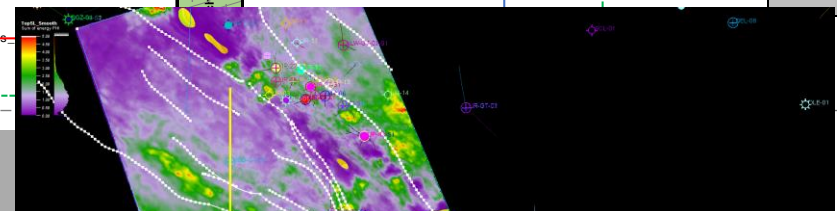
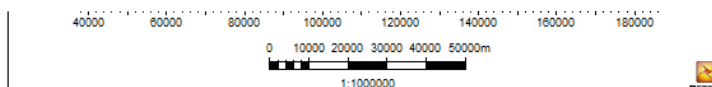
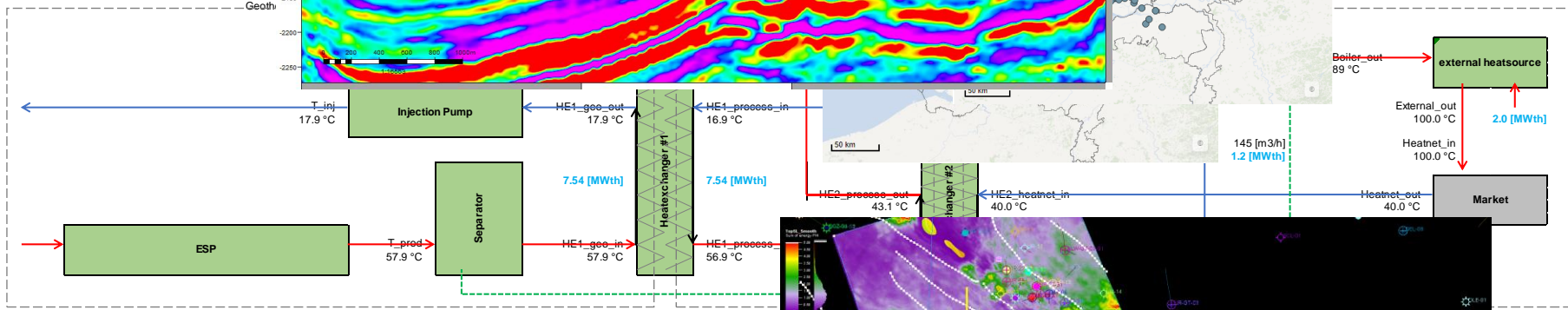
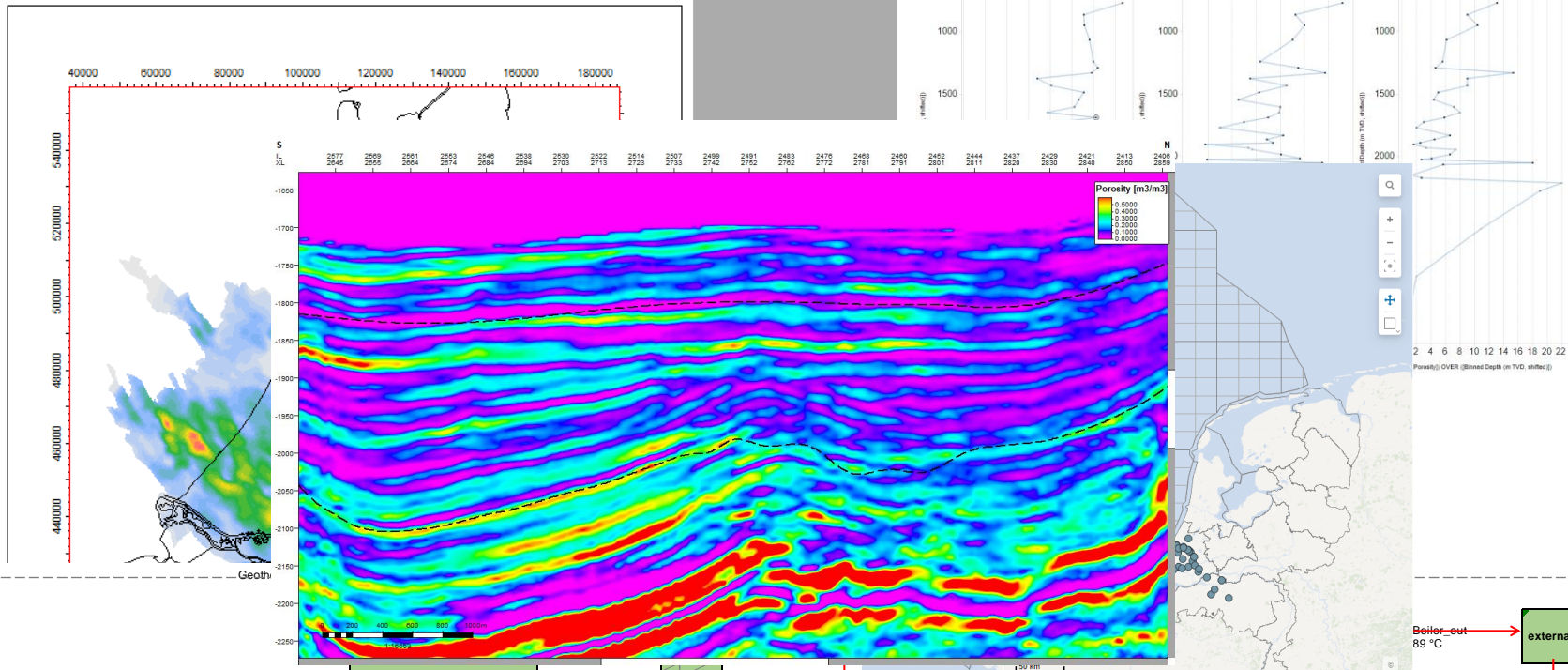
11:30 - 18:00

TNO location Utrecht
Princetonlaan 6

Preliminary program

- 11:30 - 12:00 *Registration & coffee*
- 12:00 - 12:10 *Welcome*
- 12:10 - 12:30 **Roel Verreussel & Daan den Hartog-Jager ~ TNO & EBN:**
Introducing the geology of the West Netherlands Basin
- 12:30 - 13:20 *Lunch & Posters*
- 13:20 - 13:40 **Herman van der Veen ~ Shell:**
Rejuvenation of an old hydrocarbon basin. How to explore for geothermal sweet spots
- 13:40 - 14:00 **Roel Verreussel ~ TNO:**
Syn-rift depositional patterns of the Nieuwerkerk Formation
- 14:00 - 14:20 **Annelotte Weert ~ University of Naples:**
Tectono-stratigraphic reconstruction of the West Netherlands Basin
- 14:20 - 14:40 **PanTerra Geoconsultants B.V.:**
Cyclicality patterns of the Alblasterdam - impact on geothermal resource potential
- 14:40 - 15:40 *Coffee break & Posters*
- 15:40 - 16:00 **Quinten Boersma & Lara Borst ~ IF Technology:**
Leaching in the West Netherlands Basin
- 16:00 - 16:20 **Mart Zijp ~ HVC:**
Presence and absence of Nieuwerkerk Members: results of an 8 well drilling campaign
- 16:20 - 16:40 **Hemmo Abels ~ TU Delft:**
Delft Aardwarmte Project
- 16:40 - 17:00 **Marianne Leewis ~ EBN:**
Geothermal potential of the Alblasterdam Formation
- 17:00 - 18:00 *Social drinks & Posters*

For more information and questions
email: symposiumwestnetherlandsbasin@gmail.com



Geothermal potential of the Alblasserdam Fm

Example 58 degC

250 perm / 1500 – 7.5 MW → 14 MW → 0.18 PJ (3500) / 0.40 PJ (8000)

500 perm / 1500 – 12.5 MW → 20 MW → 0.25 PJ (3500) 0.58 PJ (8000)

100 perm / 1500 – 5.5 MW → 7 MW

180000 GJ – 580000 GJ

920 GJ/ha → 195 ha / 630 ha / 1.95km² / 6.3 km² →

530 GJ/ha → 339 ha / 1094 ha / 3.39 / 10.94 km

180 GJ/ha → 1000 ha / 3222 ha / 10 / 32.22 km²

18 GJ/ha →

Eindhoven: 88 km²

Waalwijk 21 kme



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