

Dutch Geothermal Landscape A Perspective from a New Entrant

15 October 2021



- Yeager Energy founded in May 2018 by two Delft Mining Engineers with significant international oil and gas experience.
- Substantial investment by energy focused investment fund Kerogen Capital, enabling Yeager to execute on its strategic goals.
- Three exploration licenses submitted: Nissewaard, Oude Rijn 1 & Purmerend 3.
- Award of exploration permit 'Oude Rijn 1' in August 2021.
- Acquisition of Warmtebedrijf Westland Ontwikkeling B.V. in June 2021.
- Participate in 'Aardwarmte Delfland' project with Shell Geothermal and greenhouse companies Harting & De Bruin. Two doublets and district heating network.
- Offices in Schiphol and Naaldwijk.







- Develop and operate conventional deep Geothermal energy (wells) and (smart) District Heating Networks.
- Complete heat value chain
 Source to Sales' → Heat Production Storage Transport Distribution Heat / Cold sales Services.
- **Portfolio Approach** Standardise, reduce costs, spread risks, learn.
- Innovate apply oil/gas practices in innovative way to geothermal energy. Apply smart digital technology.
- Organic and inorganic growth.
- Partnerships / co-operations (operated / non-operated).
- **Expand** internationally, both Heat & Power.
- High regard to HSE, Integrity and Stakeholder Management.



YE Current Projects

- Oude Rijn 1 license (awarded)
 - Low risk geology, with many oil/gas wells drilled nearby
 - Industry, greenhouses and residential: several cities
- De Lier Aardwarmte Delfland (ongoing)
 - Shell operator wells, Yeager/WBW operator network
 - Up to 2 doublets, 60 MW
 - Greenhouses & residential
 - First heat sales 2023/2024
- Nissewaard license (pending)
 - Proven geology, excellent geothermal potential
 - Industry and residential
- Purmerend 3 license (pending)
 - Low risk geology, with many gas wells drilled nearby
 - Existing District Heating network
- Business Development:
 - 25+ potential projects in The Netherlands being ranked
 - International business development





- The greenhouse horticulture companies are the true pioneers of geothermal energy in The Netherlands. Having overcome many obstacles, we now have 26 geothermal systems.
- A lot has been achieved but there is still a long way to go for geothermal energy to be accepted as a proven, safe, reliable and affordable form of sustainable energy.
- On one hand this is proven technology applied in many cities around the world and there is a bright future ahead of us....
- At the same time the challenges are many: public acceptance, technical, commercial, safety, licensing & permitting, legal,....
- Perceptions and reality Perception is reality











Groningen 2016







- There is a bright future if we play it right.
- This is proven technology applied in many cities around the world.
- Momentum is building focus and pace for geothermal is picking-up.





- Ormat Technologies, Inc. (ORA) a public company which supplies geothermal energy technology.
- Built > 190 power plants and supplied related equipment worldwide: N & S America, EU and AustralAsia.
- In mid 2019 its share price surpassed the main conventional oil & gas companies.

YE Paris – Geothermal Energy & District Heating

- Paris since 1969 proven application of (conventional) geothermal energy & District Heating Network (DHN) with 750,000 customers.
- Plans to double capacity to 1,250 MWth en production to 4,000 GWh in 2030. No subsurface seismic events (earth tremors).
- Five water bearing reservoirs (aquifers). Depth 1,500 2,000 m. Temperatures 56 - 85°C.
- Similar conditions exist in The Netherlands.
- Several cities: München, Milaan, Reykjavik, Heerlen, Reno (NV), etc.





MAP OF THE PARISIAN HEAT NETWORK



YE Paris – Geothermal Energy & District Heating

Paris / Netherlands to scale.







- Technical (drilling & production)
- Infrastructure
- Licenses
- Public acceptance

YE Geothermal Wells – Drilling performance

Drilling

- NL 75 years experience in drilling wells (5,500 wells).
- Upfront costs & long-term reliability.
- Drilling performance significantly improved.
- Scope for further improvement:
 - Geothermal standards.
 - Long-term well & completion integrity.
 - Integrated multi-disciplinary well design.
 - Supervision & planning.
 - Material selection.
 - Drilling mud selection.
 - BHA selections.



YE Geothermal Wells – Production

Production

- NL 75 years experience in production (oil/gas/water) and injection (water).
- Long-term well integrity & productior reliability.
- Currently 26 doublet-system no significant increase in new doublets since end 2019.
- Number of operational doublets decreasing since beginning 2018 and the gap is widening!
- Production integrity issues:
 - Completion / sand face design.
 - Corrosion choice of materials & inhibitors
 - Scaling
 - ESP run-life knowledge, qualified people, management & maintenance



YE Geothermal Wells – Masterplan Aardwarmte

Masterplan Aardwarmte

- After a good start, geothermal development stagnating.
- Lengthy licensing process.
- Lengthy permitting process.
- Licenses without activities.
- Co-operation.
- SDE⁺⁺ subsidy availability.
- Number players in market.
- District Heating infrastructure.
- High-temperature storage.
- Project finance availability.





- District Heating
 - Only 4% of Dutch households currently connected to District Heating.
 - 80% of current District Heating not sustainable
 - Up to 3.8 mln Dutch households (from 7.8 mln) can potentially be connected in 2050
- Heat infrastructure is/will be the bottle-neck for deployment of geothermal to the built environment
 - Infrastructure
 - Heat storage (legislation)
 - SDE subsidy
 - Timing/phasing (vollooprisico)
 - Regional developments open network?
- Discussion
 - Role municipalities/provinces
 - Public / private companies / co-operation
 - Role Network operators (netbeheerders)
 - Ministry ACM Municipalities Network operators
 - New Heat Law (Warmtewet 2.0)



YE Built Environment – Heat infrastructure systems

- Hybrid systems with multiple sources (data centres, waste heat, geothermal, aquathermal, etc.)
- Open networks, connecting different sources, storage and customers.
- Collaboration between owners of sources to secure supply, flexibility, reliability and efficiency (lowest possible cost to end user).
- Heating & cooling.
- Geothermal landscape will have to change away from 'islands' towards 'hybrid integrated systems'.
- Yeager's strategy fits very well with this approach.
- Coordination?



Warmte Systeem Westland: future vision of integrated supply system serving horticulture and residences.

(picture from Energy Transition Partners)

YE Licensing process

Ministry goals for license process time

- Total procedure: <u>45 weeks (315 days)</u>.
- Term following first publication State Gazette (Staatscourant): 39 weeks or <u>273 days</u>.
- In practice average duration for geothermal exploration license award following first publication is 562 days !

Some improvements lately?

EZK Procedure - Streefwaarde termijn	weken	dagen
Ontvangstbevestiging aanvraag	1	6 weken
Ontvangst pre-advies (*)	3	=
Publicatie Staatscourant	2	42 dagen
Gelegenheid indienen concurrerende aanvragen	13	
Advisering door TNO-AGE, SodM, provincie, gemeente, waterschap (*)	8	
Advisering door Mijnraad (*)	6	39 weken
Besluitvorming EZK en toezending besluit aan aanvrager en adviseurs	4	= 273 dagen
Publicatie besluit Staatscourant	2	
Bezwaar periode (*)	6	
Vergunning onherroepelijk	0	
Totaal	45	

(*) variabel: deze streeftermijnen zijn afhankelijk van onder andere verzoeken van EZK aan de aanvrager om de aanvraag aan te vullen, al dan niet op verzoek van de adviseurs, of in afwachting van

Ministry (MEAC) - Process time award geothermal exploration license

(Average # days for awarding license in access of the prescribed 273 days is 289 days. Total average is 562 days)



First publication State Gazette (Staatscourant) - Invitation for competing license request

Expected publication State Gazette - Award of geothermal exploration license by Ministry (39 weeks = 273 days)

Actual publication State Gazette - Actual award of geothermal exploration license (# extra days - average 289 days in addition to expected 273 days)



- There are more licenses than there is activity (idling).
- Large license areas not fully utilised.
- Licenses not awarded nor denied.
- Parties sitting on licenses without any activity.
 - No interest
 - No time or resources
 - No business case, but holding onto license
- Co-operation limited (more parallel operations). Competing and co-operation can go together.
- Fallow acreage initiative?



Public acceptance

- Let us not be complacent and become like the biomass sector.
- Communication (education) & stakeholder management should be highest on everyone's agenda.
- Lack of information still little known about geothermal energy and ٠ district heating - possibility of speculation (public, media, politicians, lobbyists, investors, others).
 - **Technical**
 - Reliability ٠
 - Upfront costs and ultimate heat price for consumer ٠
 - Risks (safety, environment) ٠



Niemand lijkt nog voorstander van de bouw van 's

lands grootste biomassacentrale bij Diemen.

De Telegraaf 🥑

- Essential to address strategic groups: political decision makers, financiers and the public.
- In addition to local communication & stakeholder management, operators must always excel in all facets of their business \rightarrow HSE and reliability is a Must – we (the sector) are as good as anyone's latest performance.
- Communication on risks
 - Don't avoid the discussion but place in right context
 - Use positive not negative examples ٠

RTV

Streep door aardwarmte-onderzoek in Nieuwegein: Utrecht 'Besluitvorming gaat trager dan we dachten'



- This is a sector that has all the ingredients to be successful, if we play it right.
 - Public acceptance, project financing and political support are at risk.
- The sector has made a great number of improvements in recent years, but much more is needed with regards to perception, costs, reliability and safety even more so as we move closer into residential areas.
 - HSE and reliability of systems are a MUST
 - Communication and Stakeholder Management is KEY
 - Co-operation is an ENABLER
 - Government policies to provide STABILITY
- Communication
 - Bring the positive messages
 - Risks need to be discussed openly, but in the right context.



- Yeager sees a bright future ahead.
- We will continue to develop and support the sector in all its facets.
- We will grow, both in geothermal and district heating, in The Netherlands and abroad.
- We believe in partnering and sharing.
- Attract the best staff, and develop young talent.





Come and see us at our information stand.

or send email to:

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