



GEBRUIKERSPLATFORM  
**bodemenergie**

# Nationaal Symposium Bodemenergie 2026

*Donderdag 28 mei 2026 | 12.30 – 17.30 uur  
a.s.r. Nederland, Archimedeslaan 10, Utrecht*

# Programma

- 12.30** Ontvangst met koffie, thee en water
- 13.00** Opening door dagvoorzitter Henk van Zoelen
- 13.10** Welkomstwoord en visie – Martin Bloemendal (TU Delft & TNO)
- 13.20** Uitreiking WKO Duurzaamheid Award
- 13.45** Bodemenergie in ontwikkeling – Martin Bloemendal (TU Delft & TNO)
- 14.20** **Pauze | WKO-tool & kaartlaag Indicatieve energieprestaties OBEs**
- 15.00** **Parallelsessies in drie zalen (3 × 25 min, 5 min wisseltijd)**
- 16.35** **Plenaire terugkoppeling en afsluiting – Henk van Zoelen**
- 16.45** **Netwerkborrel**
- 17.30** Einde programma

# From invisible asset to energy infrastructure backbone: Het success van bodemenergie, what is next?

Dr.ir. M. Bloemendal

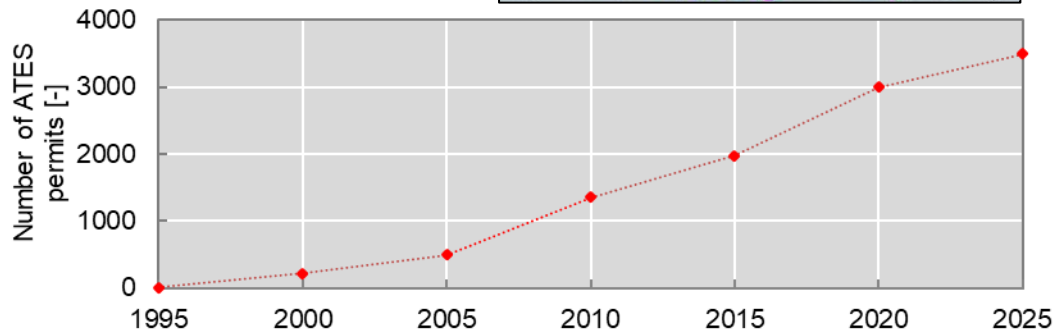
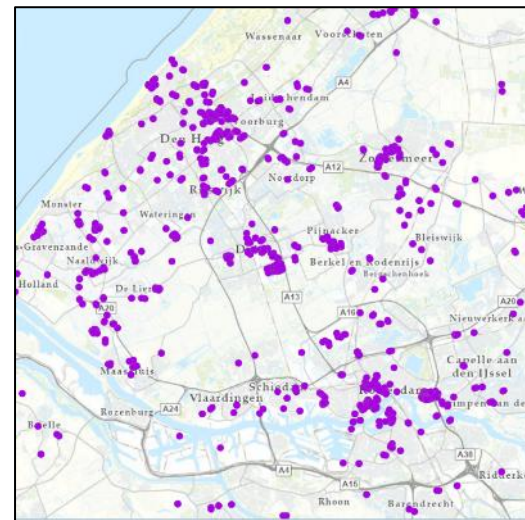
Nationaal symposium  
Bodemenergie

2026-05-28



# From innovation to the standard

- Proven technology
- High efficiency
- CO<sub>2</sub>-reduction
- Reliable



# Transition phase to other roles

Newly built

Individual systems



Existing buildings

Scarcity in subsurface space





More complex subsurface conditions

Collective systems

Limited E-availability

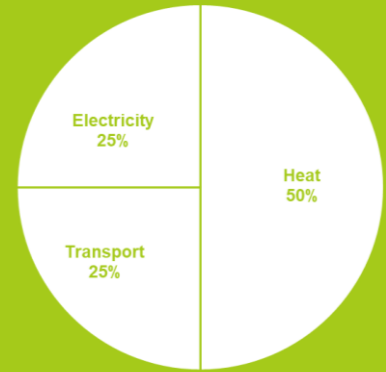
Increasing cooling demand

# Transition phase to other roles

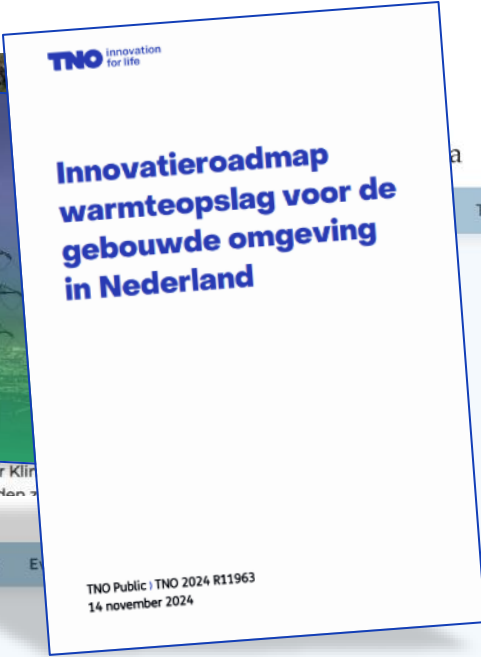
-  Seasonal buffering of LT heat
-  Hybrid systems with higher temperatures
-  Key technology for cooling
-  Flexibility for E-grid

# Heat storage, a hot topic!

## ENERGY CONSUMPTION IN NETHERLANDS



Source: CBS, 2019. Figures slightly simplified



In de langverwachte **Routekaart Energieopslag** erkent Rob Jetten, minister voor Klimaat en Energie, dat er nog veel onzekerheden zijn op het gebied van warmte. Daarbij heeft toe dat er nog veel onzekerheden zijn op het gebied van ruimtelijke inpassing en de manier waarop warmte zal er nog veel moeten worden ontwikkeld.

Niet lang na de toezegging van Jetten, al een gigantische hoeveelheid aan energieopslag. Het is voor netbeheerders TenneT, Enexis en E.ON.

"De uitwerking van de routekaart is een belangrijk onderdeel van de energietransitie."



Archief Trilemma Uit de hoek Alle Ernst

Nieuws Energie

### Actieplan moet warmteopslag vlot trekken

Sabine Sluijters 28 mei 2024

Het opschalen van projecten voor warmteopslag loopt moeizaam en pioniers vallen om, terwijl het belangrijk is voor het verduurzamen van het energiesysteem. Het kan

Trilemma Uit de hoek Alle Ernst

Trilemma

### Kan grootschalige buffering warmte het verschil maken?

Sjak Lomme 17 maart 2025

Energiea

Archief Trilemma Uit de hoek Alle Ernst Events Podcasts Meer

Nieuws Energie

### Opslag komt in norm voor energieprestatie nieuwbouw

Katrijn de Ronde 26 maart 2025

De energieprestatienorm voor nieuwbouw omvat vanaf het volgende jaar ook opslag van energie. Dat schrijft minister Sophie Hermans (Klimaat en Groene Groei, VVD) aan de Tweede Kamer. De deur naar stimulering voor thuisbatterijen zet zij op een kier.

# Challenges

- Optimal and sustainable use of subsurface
  - Planning & governance
- Integration in wider energy system
  - control and robustness
  - link with building facilities and distribution
- Technology development

# The proof in the pudding

De toekomst van bodemenergie wordt niet alleen bepaald door ambities en innovaties maar door systemen die daadwerkelijk presteren.

- Jaar in, jaar uit
- Aantoonbaar

✓ zorgvuldig ontwerp  
✓ professioneel beheer



✓ Kwaliteit en prestatie

# WKO Duurzaamheid Award 2026



# Criteria

- ▶ Gemiddelde injectietemperatuur:
  - ▶ koude bron  $\leq 9$  graden;
  - ▶ warme bron  $\geq 15$  graden;
- ▶ Gemiddelde dT over het jaar is tenminste 6 graden;
- ▶ OBES levert >70% van de jaarlijkse warmte- en koude behoefte
- ▶ Thermische balans
- ▶ >2 jaar draaien, met monitoring.
- ▶ SPF?

Genomineerd voor de WKO Duurzaamheid Award 2026

# D-Pier Schiphol

Dang Nguyen, technical expert bij AMS Schiphol

Siem Opschoor, adviseur bij DWA



## Genomineerde WKO Duurzaamheid Award 2026: D-Pier Schiphol



Genomineerd voor de WKO Duurzaamheid Award 2026

# Rijksmuseum Amsterdam

**Lester Bonn**, hoofd gebouwenbeheer en techniek bij het Rijksmuseum

**Sabine de Bijl**, contractmanager bij Kuijpers



## Genomineerde WKO Duurzaamheid Award 2026: Rijksmuseum Amsterdam



**En de winnaar is...**

# Rijksmuseum Amsterdam

**Lester Bonn**, hoofd gebouwenbeheer en  
techniek bij het Rijksmuseum

**Sabine de Bijl**, contractmanager bij Kuijpers

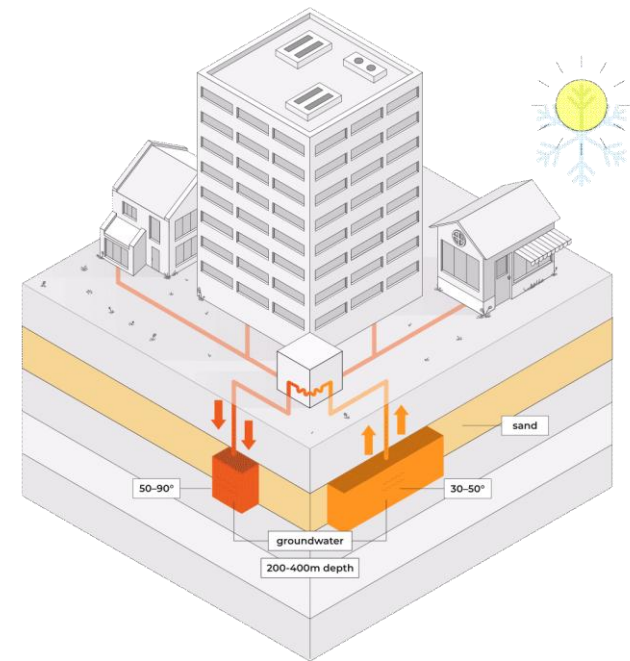


# Unlocking UTES for the next phase of the energy transition

Dr.ir. M. Bloemendal

Nationaal symposium Bodemenergie

2026-05-28



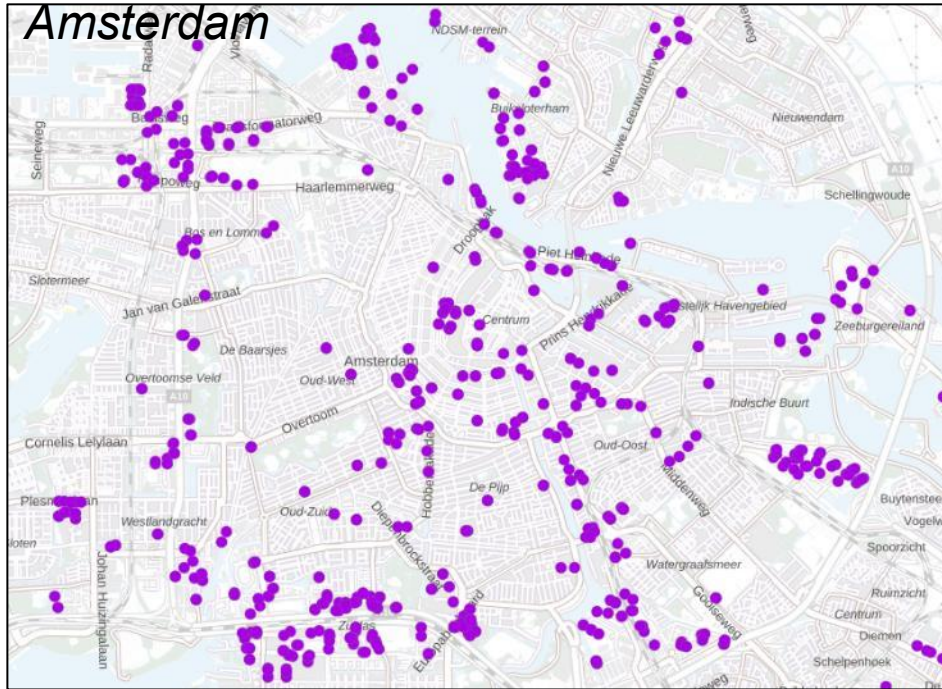
# Challenges

- Optimal and sustainable use of subsurface
  - Planning & governance
- Integration in wider energy system
  - control and robustness
  - link with building facilities and distribution
- Technology development

# Optimal and sustainable use of the subsurface

# The Crowded Subsurface

## ATES systems in Amsterdam



In 2025: LGR

~3 000 ATES

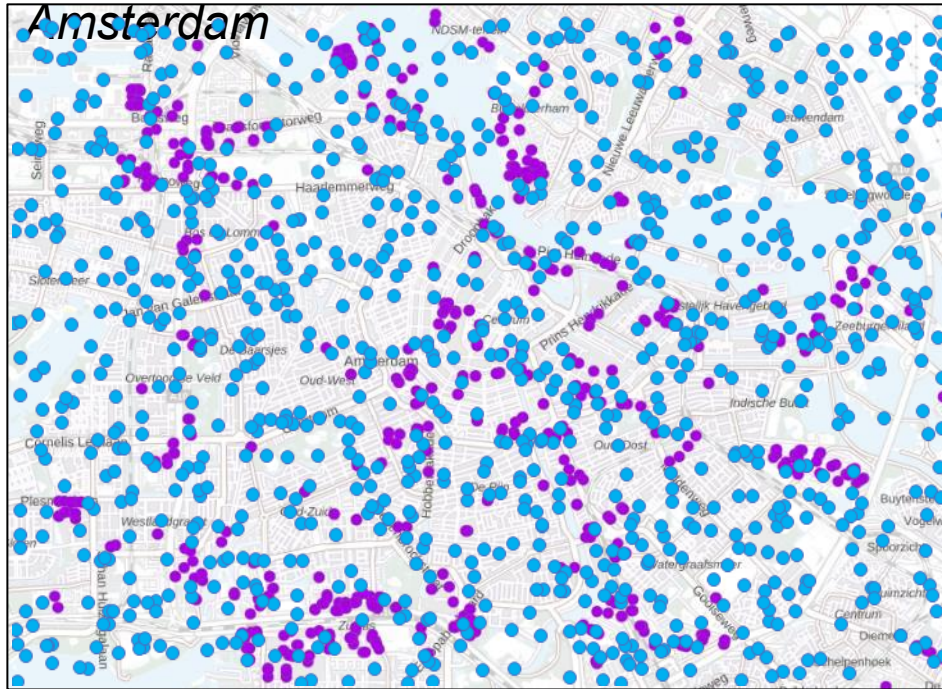
CE Delft,  
PBL,  
Min BZK

In 2050:

>100 000 ATES

# The Crowded Subsurface

## ATES systems in Amsterdam



In 2025: LGR

~3 000 ATES

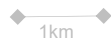
CE Delft,  
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In 2050:

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TNO

TU Delft

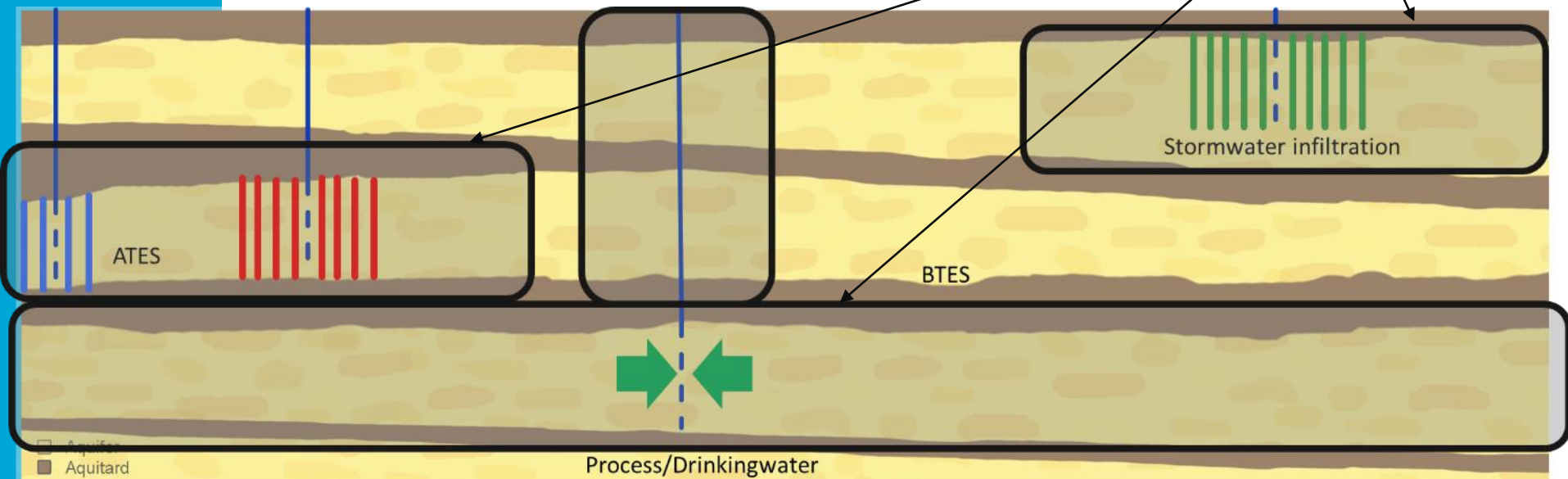


WKOtool.nl, May. 16, 2022



# The paradox: scarcity by design

Spatial claims in permits

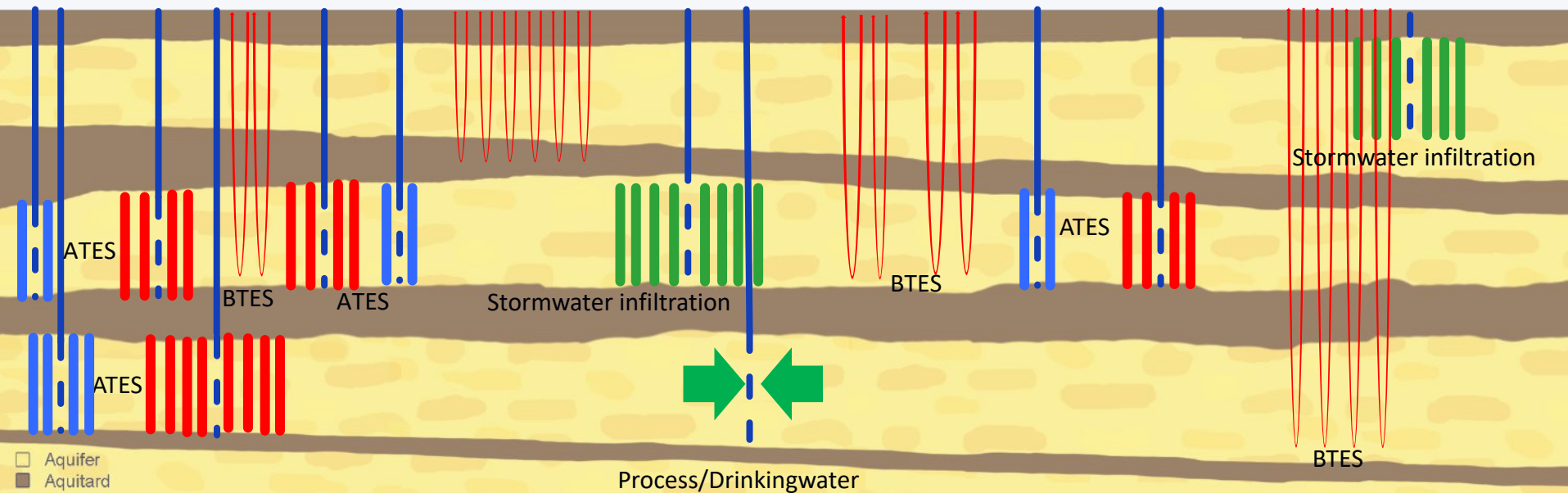


# Vision: from separation to co-existence

## → Sustainable dense subsurface space use

- Vertical stacking of functions
- Lateral placement in same layer
- Temporal Sequencing for Reuse

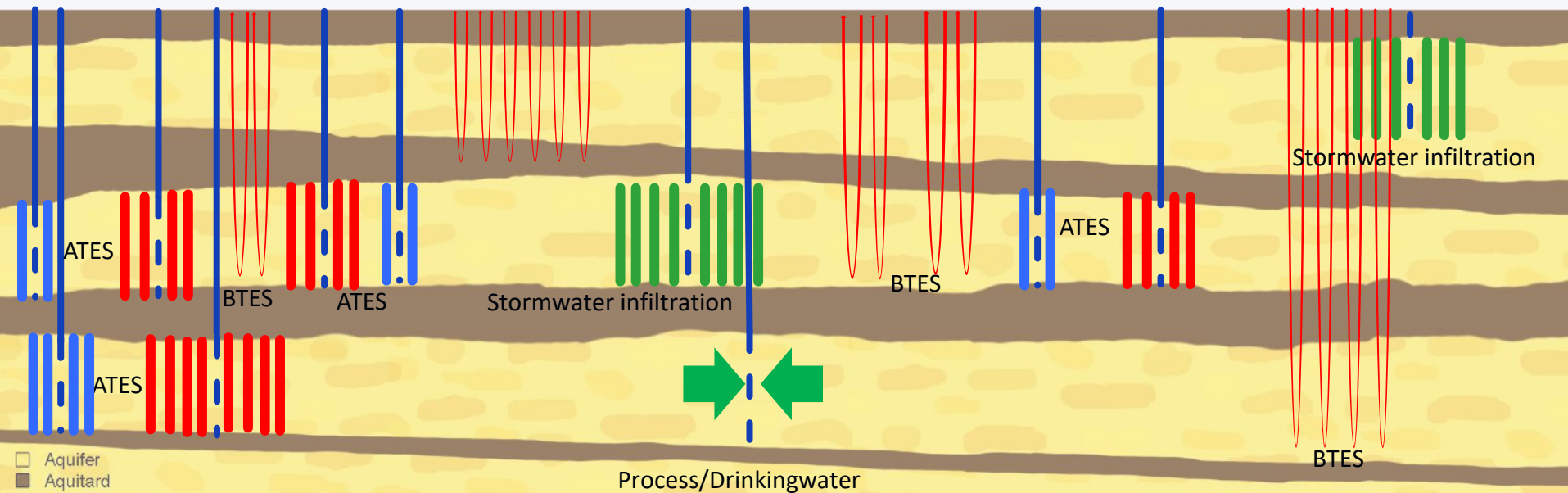
Structured co-existence involves managing interactions to minimize negative impacts and maximize benefits for society.



# Need for innovative policy and tools

Growing subsurface demand calls for new governance models and technical solutions to enable coexistence of multiple uses.

i.e. the invisible stakeholder: future users of our common resource



# Need for innovative policy and tools

Growing subsurface demand calls for new governance models and technical solutions to enable coexistence of multiple uses.

Dynamic management of actual use and adaptive planning

Assess / manage subsurface interactions

15.30

## 4D-modellering ondergrond en energieplanning in Rotterdam - Ruimtelijke winst door gedetailleerdere modellering

Gemeente Rotterdam heeft zelf een nieuw bodemenergieplan opgesteld voor het gebied Rotterdam Central District-XL. Uit de inventarisatie van dit gebied bleek dat er voor de toekomst een (te) groot aantal systemen zijn voorzien. Met een 4D model ( X-,Y-,Z- en Tijd-) hebben we de filters van bestaande en nieuwe systemen ingepast en doorgerekend. Daaruit bleek de grote meerwaarde van het doorrekenen van de daadwerkelijke filterstelling. Tijdens onze presentatie zullen we met de Rotterdam viewer resultaten laten zien in 4D. We leggen uit hoe deze 4D-modellering past in de verdere energieplanning en welke stappen daarbij worden gezet.

*Door Roland van Rooijen en Tobias Mulder, van ingenieursbureau gemeente Rotterdam.*



# Need for innovative policy and tools

Growing subsurface demand calls for new governance models and technical solutions to enable coexistence of multiple uses.

Dynamic management of actual use and  
adaptive planning

Assess / manage subsurface interactions

Holistic / cross sectoral assessment of  
subsurface space allocation

Quantify subsurface space use broader  
impacts

# The good news!

What the law actually allows:

- Omgevingswet: “evenwichtige toedeling van functies” → balanced allocation of subsurface space
- Nota Ruimte: “meervoudig ruimtegebruik” → multipurpose use

[en derde lid](#), in acht genomen.

## Artikel 4.2. (toedeling van functies aan locaties)

- 1 Het omgevingsplan bevat voor het gehele grondgebied van de gemeente in ieder geval de regels die nodig zijn om een evenwichtige toedeling van functies aan locaties.
- 2 Bij omgevingsverordening kunnen alleen regels worden gesteld over activiteiten die gevolgen hebben of kunnen hebben op de fysieke leefomgeving met het oog op een evenwichtige toedeling van functies aan locaties, als het onderwerp doelmatig en doeltreffend met een regel als bedoeld in [artikel 2.22](#) of een instructie als bedoeld in [artikel 2.3](#) worden behartigd.

## Artikel 4.3. (grondslag rijksregels)



# Cross-sectoral assessment framework

Societal Cost Benefit Analysis (SCBA) → Broad prosperity perspective:

- Direct effects: (re)investments, maintenance, usage costs, etc.
- Indirect effects: labour market, housing market, etc.
- External effects: climate impact, refrigerant leakage, impact on electricity grid, health

Not a zero-sum game: gains in one domain can contribute or facilitate to gains and/or losses in other domains

**15.30** Keuze HT-systemen vs. ZLT-systemen/MKBA rapport CE Delft (mogelijke uitbreiding met beschouwing CO<sub>2</sub>-emissie materialenkant).  
Het is bekend dat de warmte- en koudetransitie veel meer is dan een optelling van euro's. Het is een sociale transitie waarin we maatschappelijke voor- en nadelen moeten meenemen in de afwegingen en keuzes voor duurzame oplossingen voor het verwarmen en koelen van de gebouwde omgeving. Namens TKI Urban Energy hebben CE Delft, To Realize Concepts (2RC) en Tri-Es Consultancy een raamwerk ontwikkeld voor de maatschappelijke afweging van de juiste keuzes in de transitie. Een keuze die niet alleen is gebaseerd op de financiële parameters, maar ook op leefbaarheid, gezondheid, comfort, schaalbaarheid, ruimtegebruik en sociale dimensies. Met dit raamwerk kan men een betere keuze maken voor een langetermijnoplossing die in de breedte het beste is voor de maatschappij. Deze presentatie toont hoe je dit raamwerk als afwegingskader kunt gebruiken en waar de ontwikkelpunten zitten om dit in de komende jaren nog verder uit te werken.  
Door Benno Schepers van CE Delft.

uikersplatform Bodemenergie 2026



## Challenge 1. Identifying these effects

Not just a trade off between societal value for drinking water, energy storage, or climate change mitigation/adaptation

## Challenge 2. Quantifying these effects

Value for society by shifting the norm

- Shared costs
- Multipliers
- De-risking effects

# The core idea: adaptive/dynamic governance

- **Continuous Management**

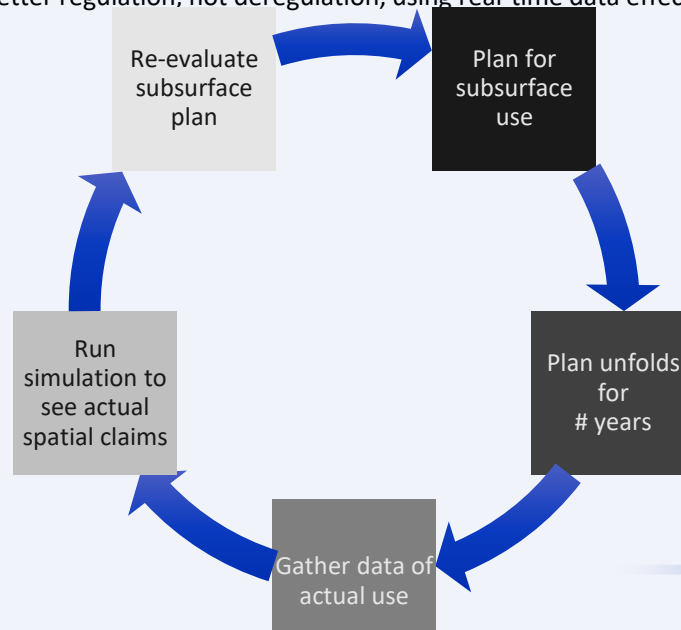
Adaptive governance relies on ongoing monitoring and updated dynamic subsurface models for effective management.

- **Dynamic Permit Adjustment**

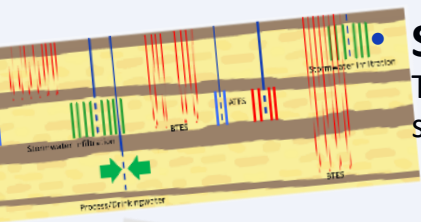
Permits and strategies are dynamically adjusted based on actual use and risk profiles.

- **Better Regulation Approach**

Adaptive management represents better regulation, not deregulation, using real-time data effectively.



# Take-home!

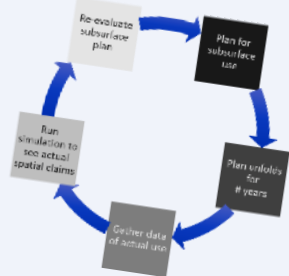


- **Subsurface is a common resource in high demand!**

The subsurface is a collective and strategic resource essential for multiple sectors and various societal challenges.

- **Adaptive / dynamic governance accommodates optimal utilisation**

Static separation of subsurface use is unsustainable; adaptive, data-driven multipurpose use is necessary and possible.



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Door Benno Schepers van CE Delft.



[martin.bloemendal@tno.nl](mailto:martin.bloemendal@tno.nl)

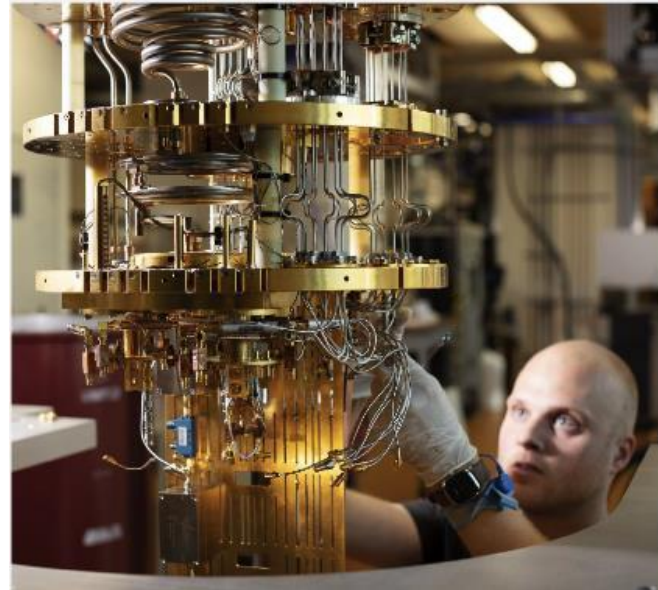
# Integration in wider energy system

# Campus South



# Developments

- Education buildings
- Data centres
- New faculty building Physics
- Cleanroom research facilities
- Quantum computing and associated research facilities



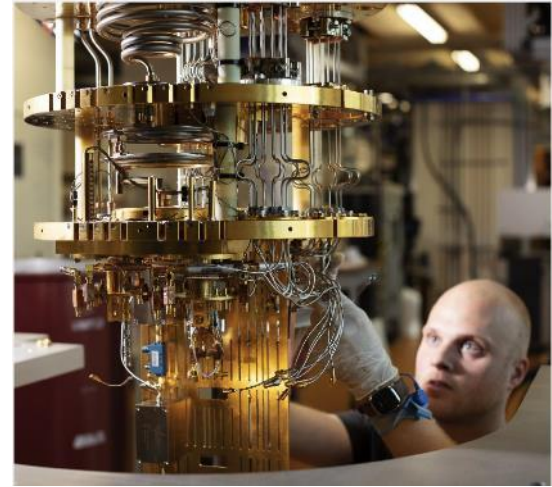
# Developments

Heating demand: ~20 TJ

Cooling demand: ~200 TJ

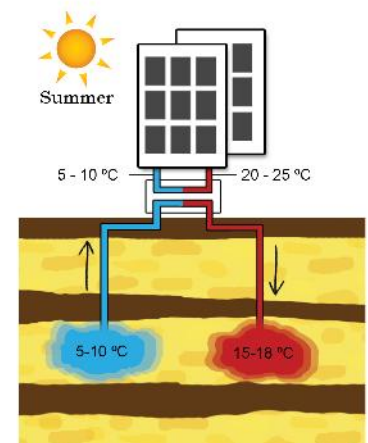
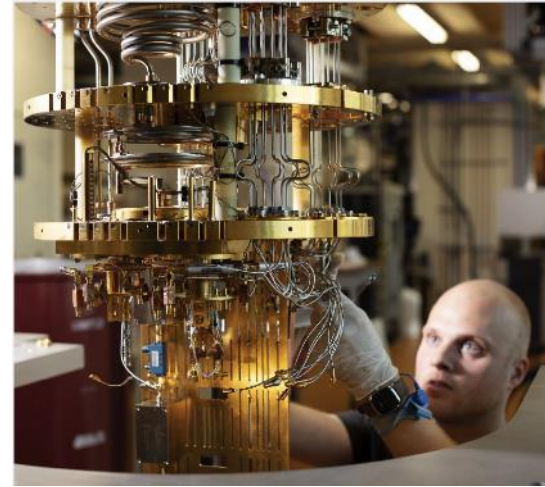
~180 TJ of heat to get rid of.

No sources for cooling available,  
only outside air via dry-coolers



# Developments

- Space cooling requires  $<5^{\circ}\text{C}$  outside air temperature for charging cold wells
- 2 data centres
  - Only possible for 800hr/year →  $>60\text{MW}$
- Cleanroom research facilities
- Quantum computer and associated research facilities
- New faculty building Physics



# Developments

- Space cooling requires  $<5\text{C}$  outside air temperature for charging cold wells

- $\rightarrow$  Only possible for 800hr/year  $\rightarrow >60\text{MW}$

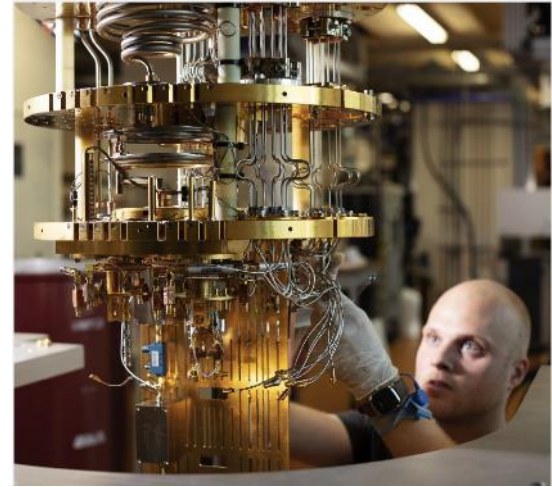
- Cleanroom research facilities

- $\sim >50\%$  is for process cooling, and associated research facilities  
also possible with higher temperatures

- Process cooling can be at higher temperature

- $\rightarrow$  cold well temperature at  $\sim 12\text{C}$

- $\rightarrow 2500$  hr/yr to harvest “cold”  $\rightarrow 10$  MW



# Normal ATES



Winter

Space heating  
with heat pump

15-17

7-9

“normal”  
ATES

TNO

TU Delft

# Normal ATES + cold harvesting



“cold” harvesting with dry coolers

Space heating with heat pump

15-17

7-9

21-23

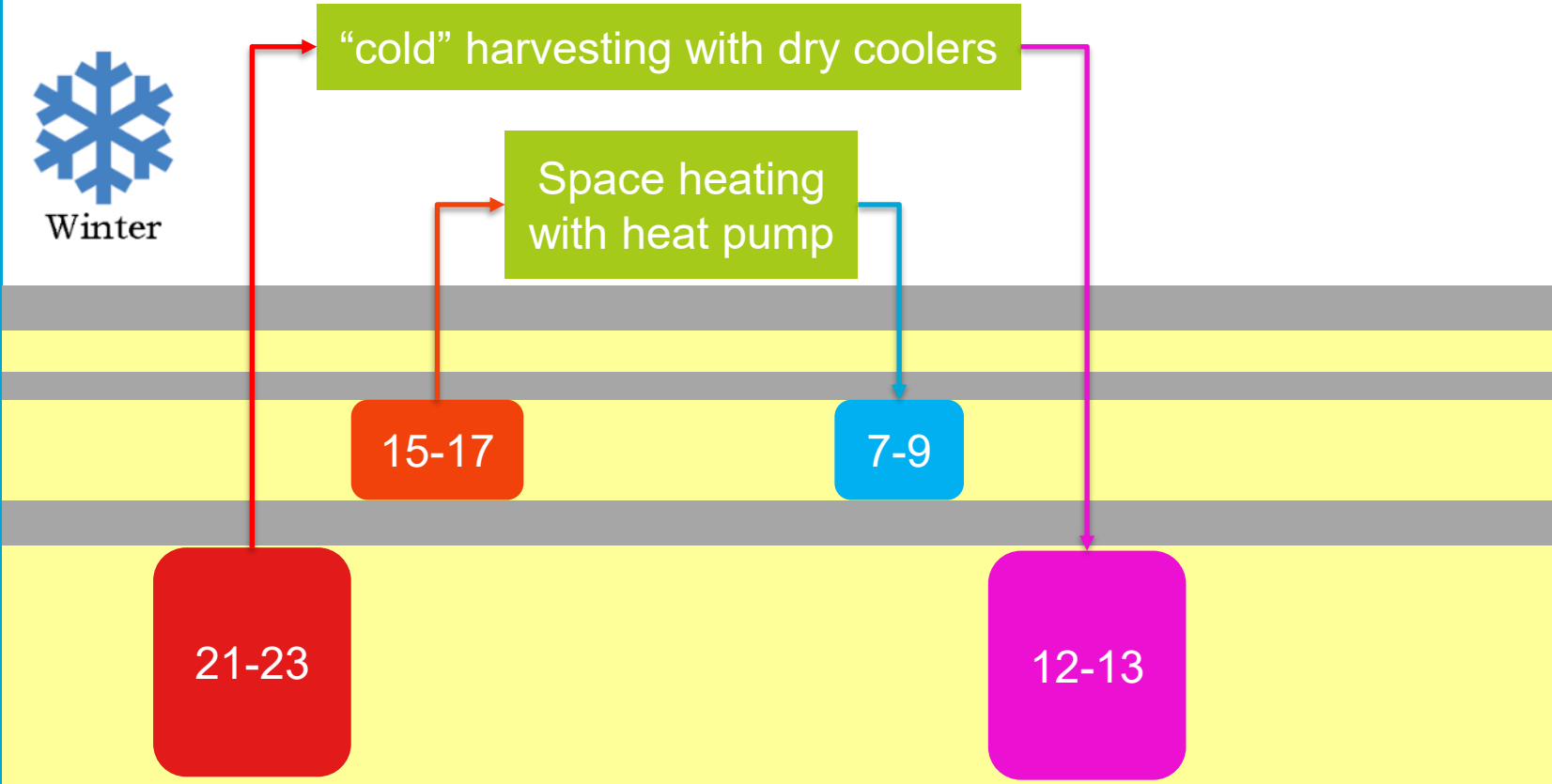
12-13

“normal”  
ATES

Process  
cooling  
ATES

TNO

TU Delft



# Normal ATES cooling



Summer

Space cooling

15-17

7-9

“normal”  
ATES

TNO

TU Delft

# Space and process cooling



techniplan adviseurs bv  
RAADGEVEND INGENIEURSBUREAU



Summer

Process cooling

Space cooling

15-17

7-9

21-23

12-13

“normal”  
ATES

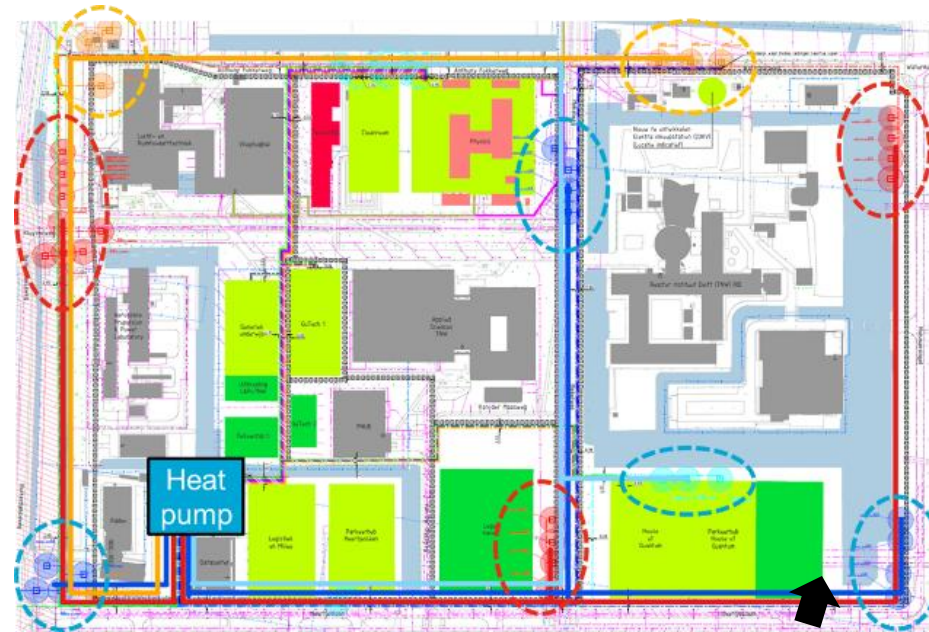
Process  
cooling  
ATES

TNO

TU Delft

# Innovation highlights

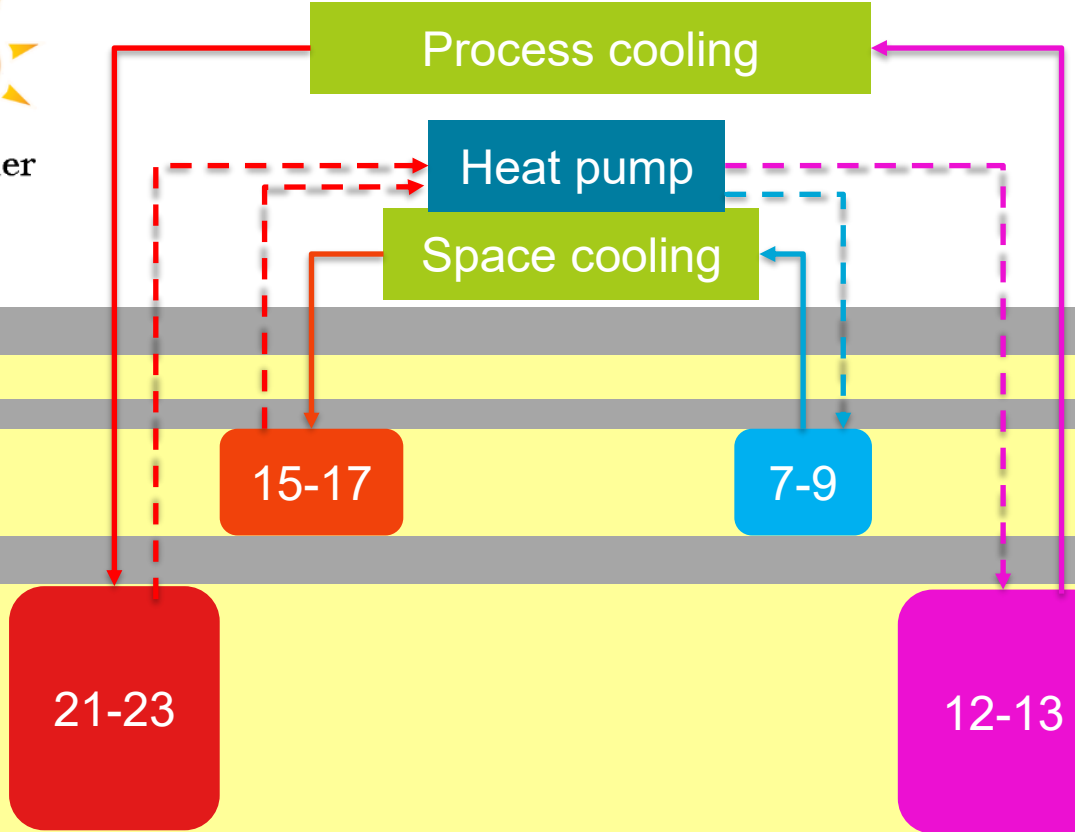
- ATES for cooling at different temperatures
- Subsurface interactions, optimal design & operation
- Sector coupling
- Optimal control



# Additionally charge cold wells: P2C



“normal”  
ATES  
Process  
cooling  
ATES  
TNO  
TU Delft

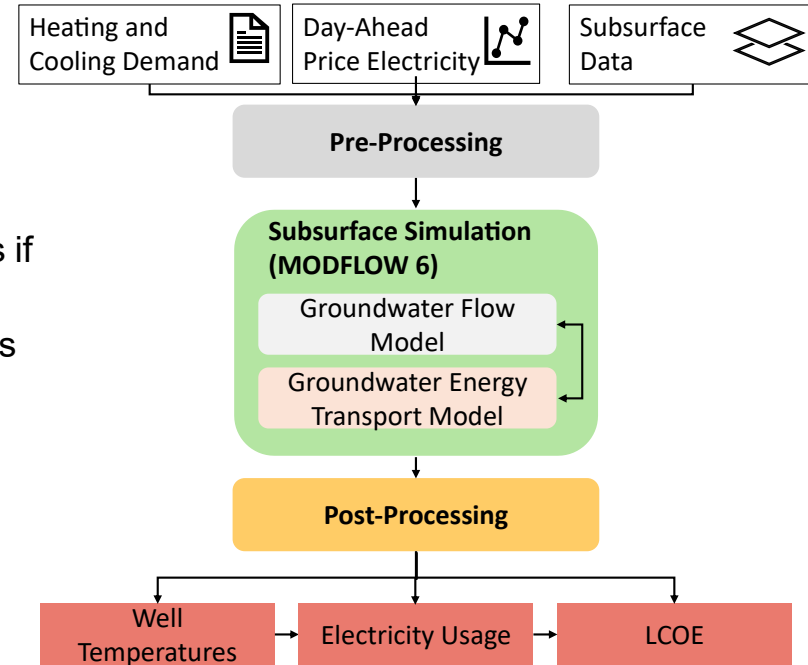


At low E-price  
Use HP to  
additionally  
charge cold wells



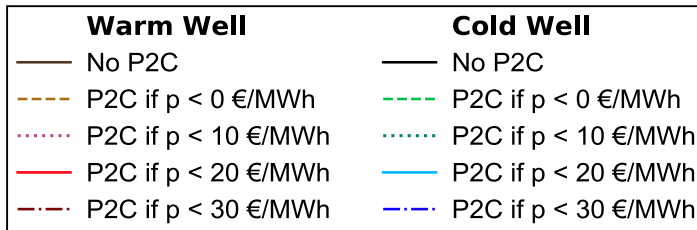
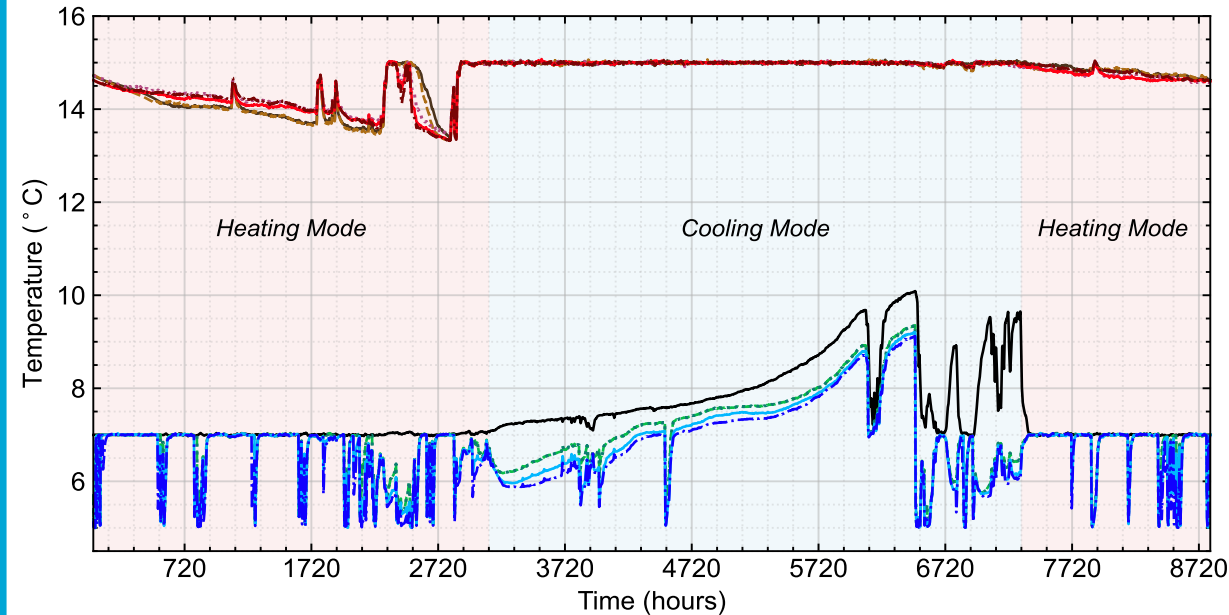
# Case Study: Delft Campus Zuid

- Rule-based operation of the ATES:
  - Temperature threshold  $T_{threshold}$ : decides if heating or cooling mode
  - Price threshold  $p_{max,P2C}$ : decides if P2C is applied (when in heating mode)



# Well Temperature

Temperature at cold and warm well in year 5



**Cooling Mode:** lower extraction temperatures at the cold well

**Price threshold:**

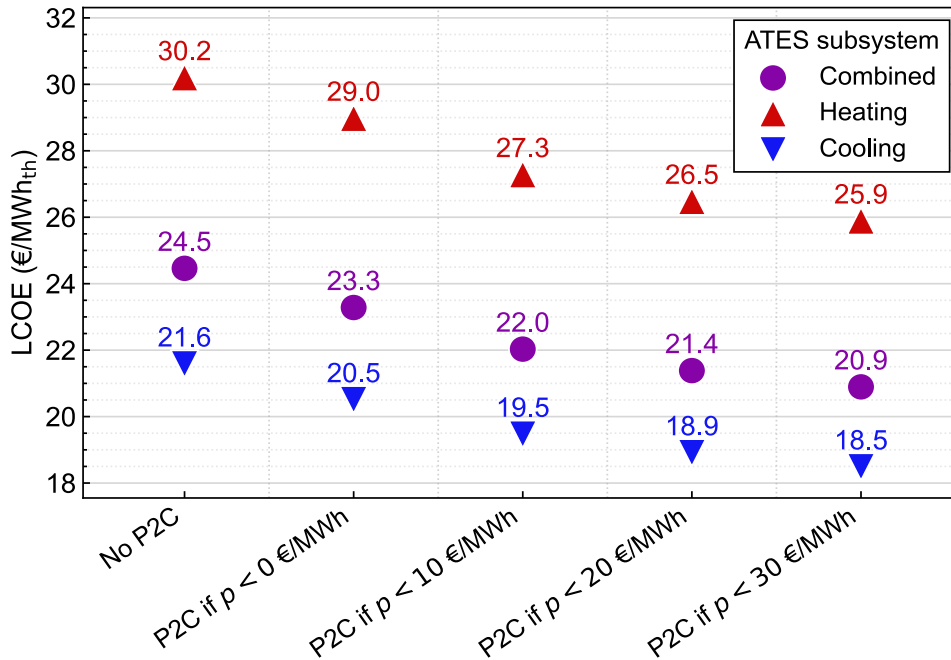
- Biggest difference from no P2C to P2C if  $p < 0$  €/MWh
- Small additional reduction of cold well temperature by increasing price threshold

# Cost of Heating and Cooling with ATES

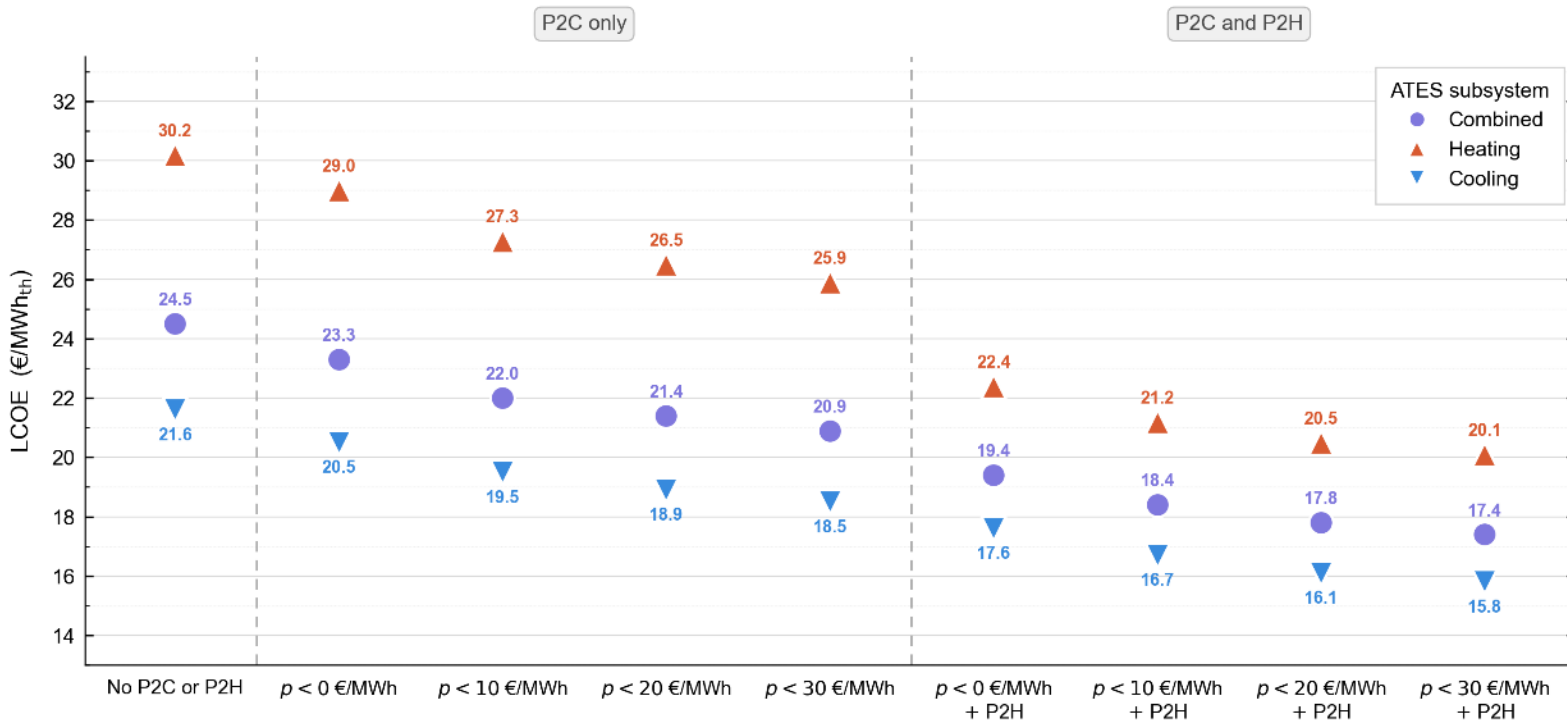
P2C reduces costs of cooling with ATES

P2C also affects LCOE of heating

LCOE of P2C scenarios after 5 years



# Cost of Heating and Cooling with ATEs



LCOE after 5 years of operation in different scenarios

# Preliminary takeaways

**P2C and P2H** operation of ATES in cooling dominated systems is promising to provide **additional flexibility** to the electricity grid while **reducing costs** for heating and cooling.

- P2C reduces cost for cooling with the ATES
- P2H reduces costs for heating, but needs P2C
- Benefits of P2C strongly depend on electricity price and demand uncertainties

# MOOI Max flex



15.00

Duopresentatie:

1) Innovatieve monitoringstechnieken voor OBES-bronnen, gericht op optimale realisatie en exploitatie (o.a. MOOI-Diameter).

*Door Roeland Nieboer van Deltares.*

2) MaxFlex-ZLT, ook een MOOI project.

Dit project gaat over het ontsluiten van flexibiliteit voor het elektriciteitsnet met OBES-bronnen en (utiliteit)gebouwen.

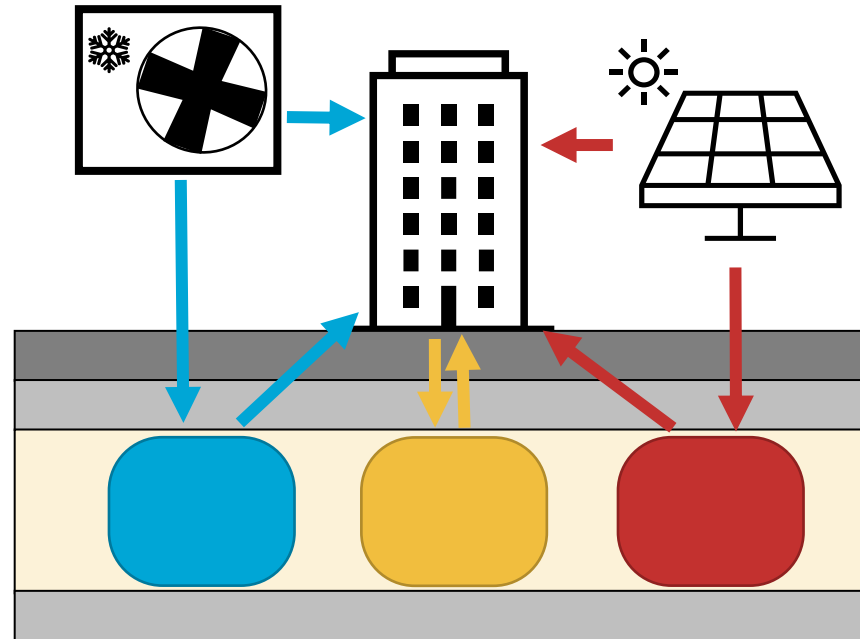
*Door Ivo Pothof van Deltares.*



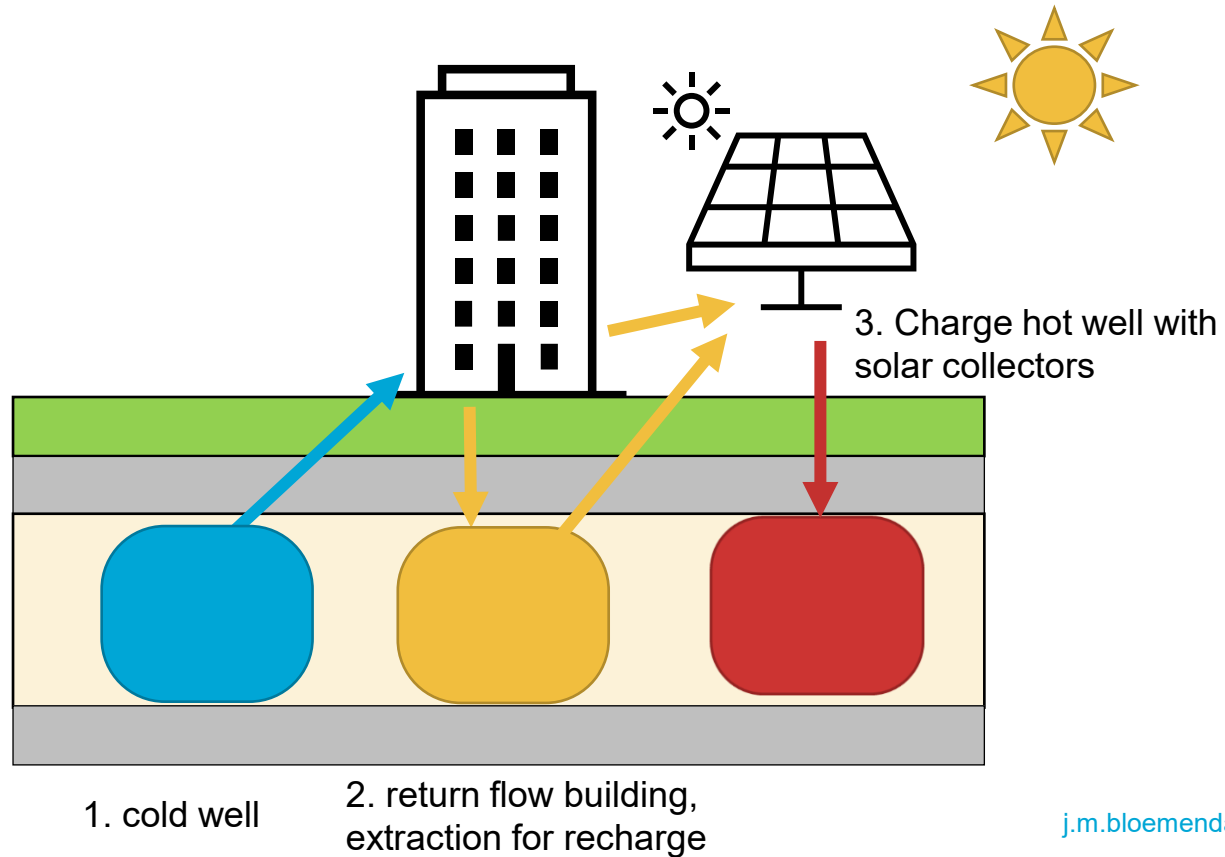
Other MOOI project on system integration aspects:

- CONNECT
- Joule 4 Joule
- CHILL
- Buildinflexergy

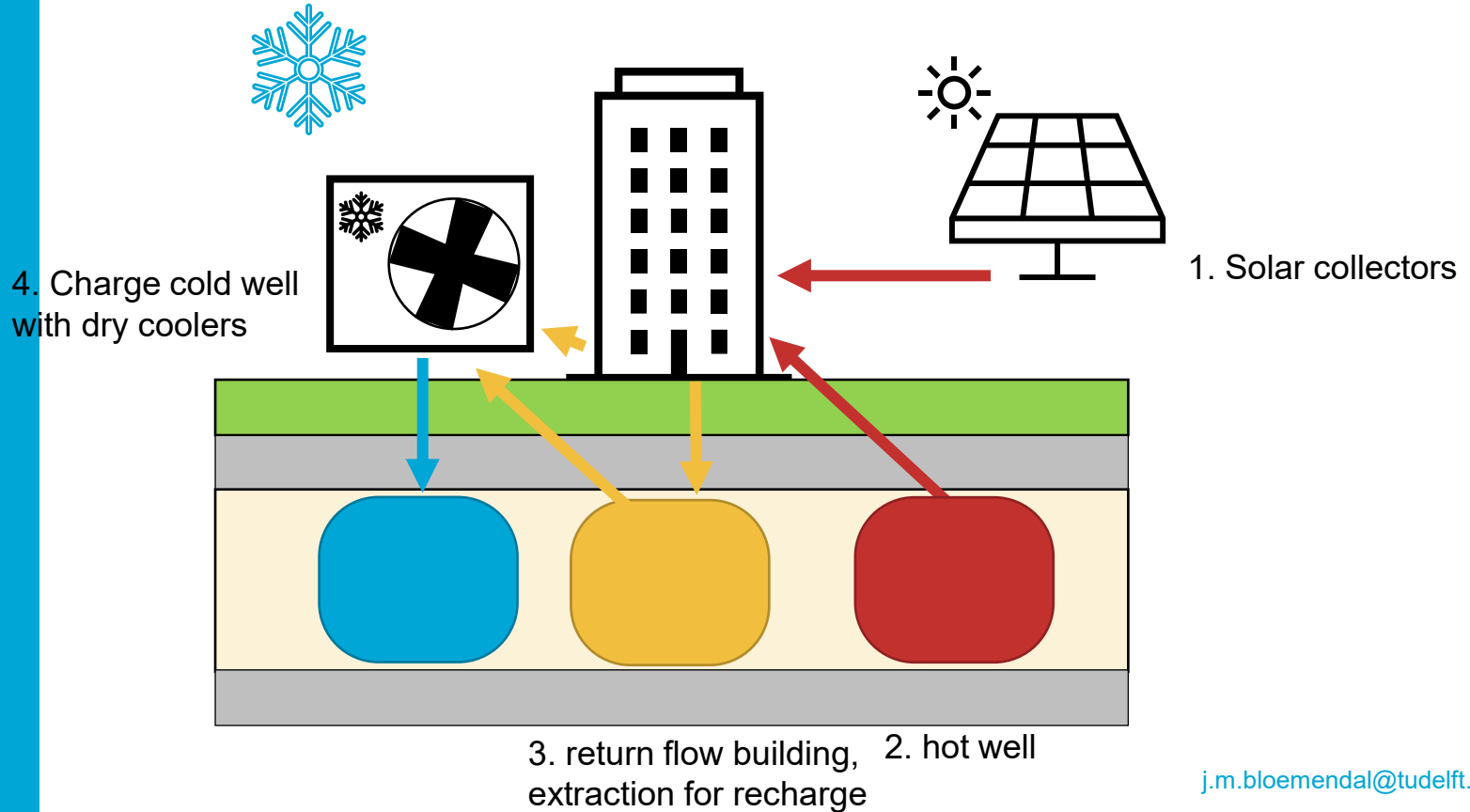
# ATES Triplet Robustness for Varying Building Supply Temperatures



# Summer operation

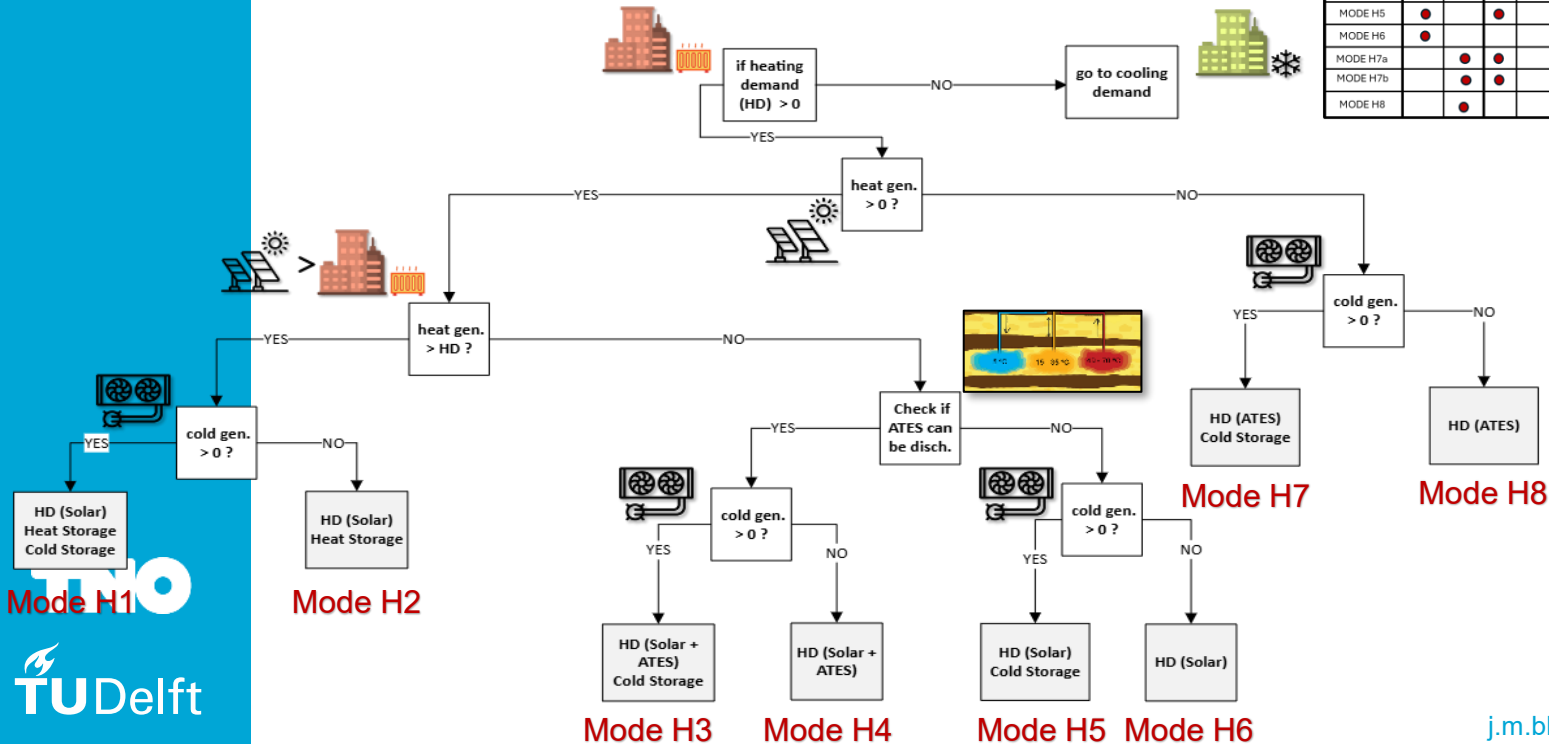


# Winter operation

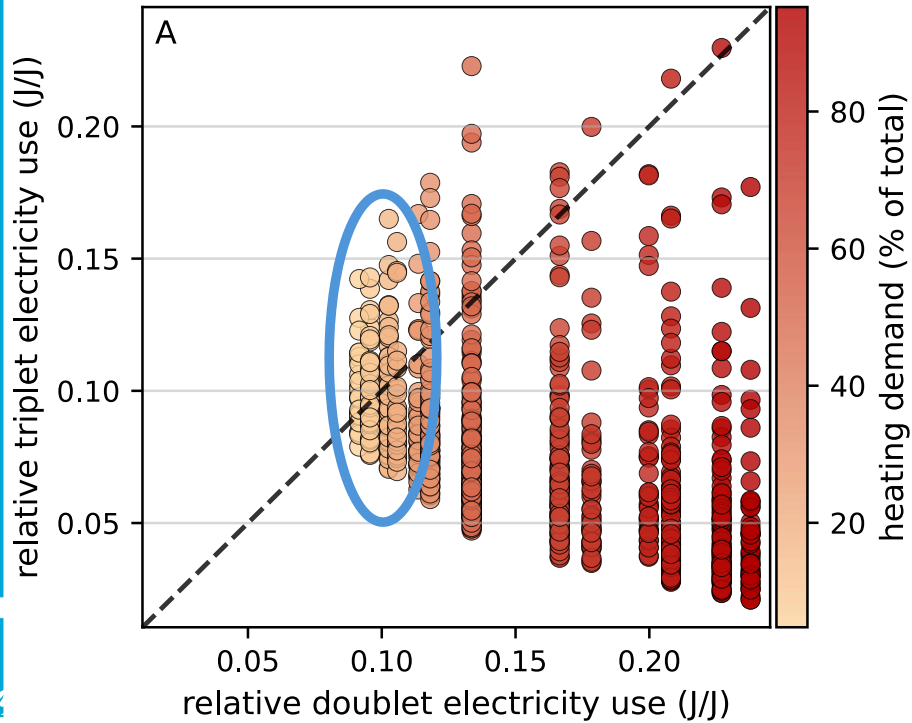


# Example Operational Mode Flowchart for Heating

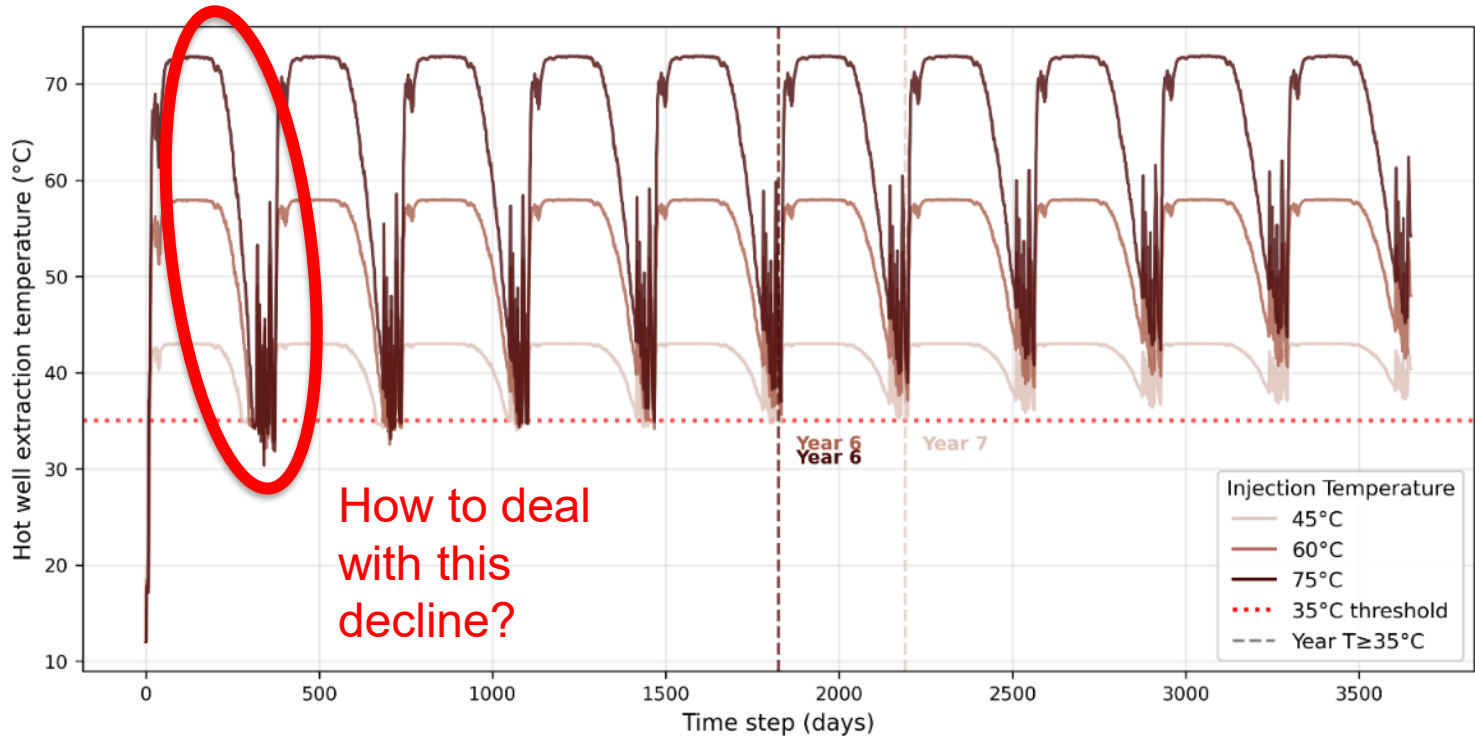
| MODES    | Heating |      | Storage |      | Cold Well |       | Well Operation |       |           |       |
|----------|---------|------|---------|------|-----------|-------|----------------|-------|-----------|-------|
|          | Solar   | ATES | Cold    | Heat | Op. Mode  | Conn. | Op. Mode       | Conn. | Op. Mode  | Conn. |
| MODE H1  | ●       |      | ●       | ●    | Charge    | c12   | Discharge      | c11   | Charge    | c1    |
| MODE H2  | ●       |      |         | ●    | n.a.      | -     | Discharge      | c2    | Charge    | c1    |
| MODE H3a | ●       | ●    | ●       |      | Charge    | c13   | Charge         | c2    | Discharge | c1    |
| MODE H3b | ●       |      | ●       |      | Charge    | c13   | Discharge      | c11   | Discharge | c1    |
| MODE H4  | ●       | ●    |         |      | n.a.      | -     | Charge         | c2    | Discharge | c1    |
| MODE H5  | ●       |      | ●       |      | Charge    | c12   | Discharge      | c11   | n.a.      | -     |
| MODE H6  | ●       |      |         |      | n.a.      | -     | n.a.           | -     | n.a.      | c1    |
| MODE H7a |         | ●    | ●       |      | Charge    | c12   | Charge         | c2    | Discharge | c1    |
| MODE H7b |         | ●    | ●       |      | Charge    | c12   | Discharge      | c11   | Discharge | c1    |
| MODE H8  |         | ●    |         |      | n.a.      | -     | Charge         | c2    | Discharge | c1    |



# Triplet vs doublet E-use



# Hot well production temperature





# Ongoing work

- **Co-simulation** captures the **complexity of building operations**, but is computationally expensive
- **Higher injection temperatures** hot well beneficial.
- **Future steps** will entail:
  - Co-Simulation in 3D
  - Extreme years in the dataset
  - Novel approaches for building heat distribution/delivery



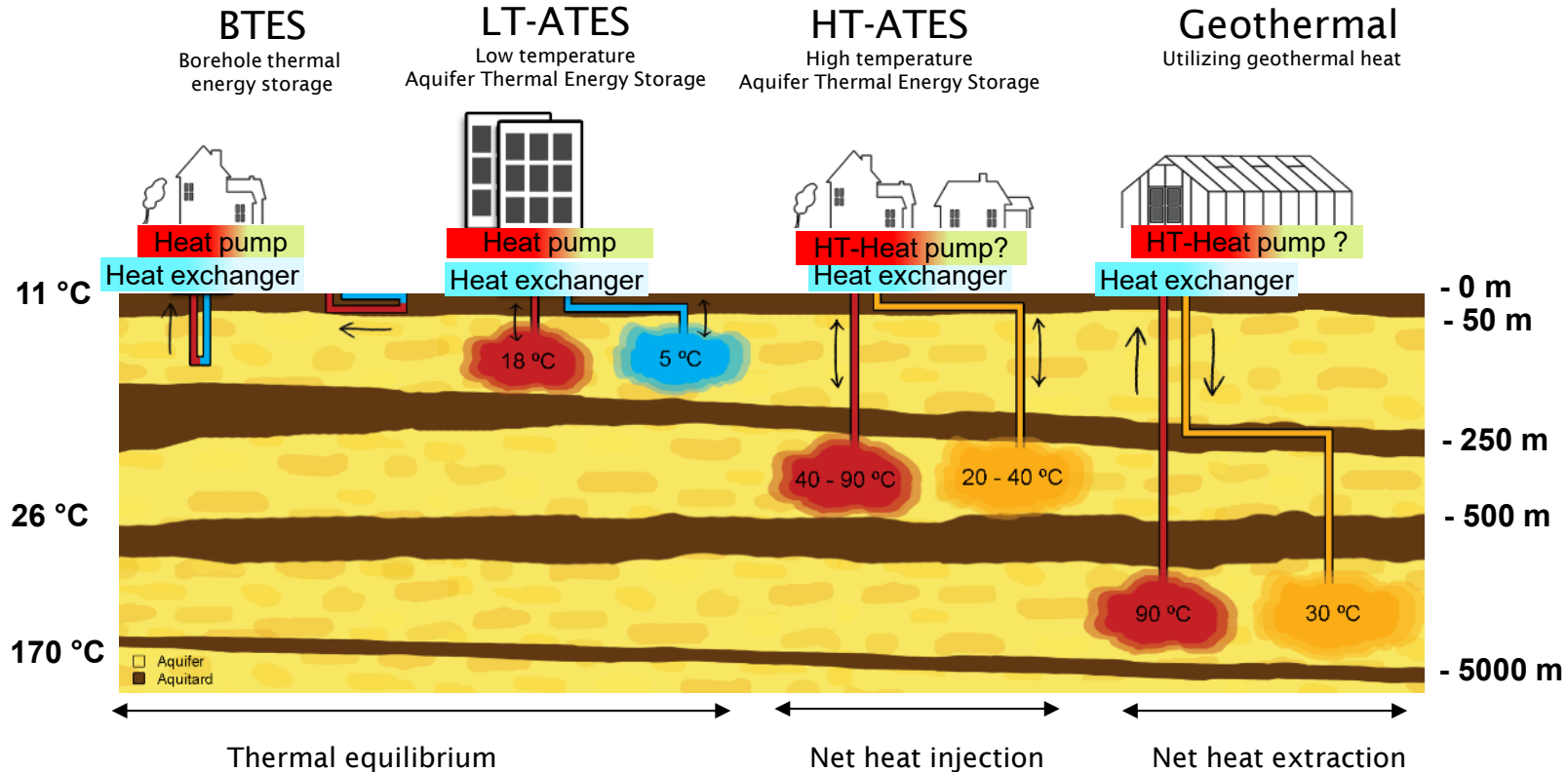
# Technology development

Higher temperatures

Drilling / completion

# The Temperature Gap

## (Existing Buildings)



# MT/HT-ATES in NL

A.

HT-ATES

▼ research phase

▼ test well complete

▲ operational

▼ abandoned

▲ proposal phase

MT-ATES

● operational

● abandoned

2 MW-project  
(Haarlem)

Shell & Firan & D4  
(Rijnland)

Hooge Burgh  
(Zwammerdam)

Utrecht University (Utrecht)

Utrecht University (Utrecht USP)  
Office Complex (Bunnik)

NIOO-KNAW  
(Wageningen)

NEXT-garden  
(Lingewaard)

Gebr. Van Duijn (Steenbergen)

Heuvelgalerie Shopping Mall  
(Eindhoven)

Shell  
(Leeuwarden)

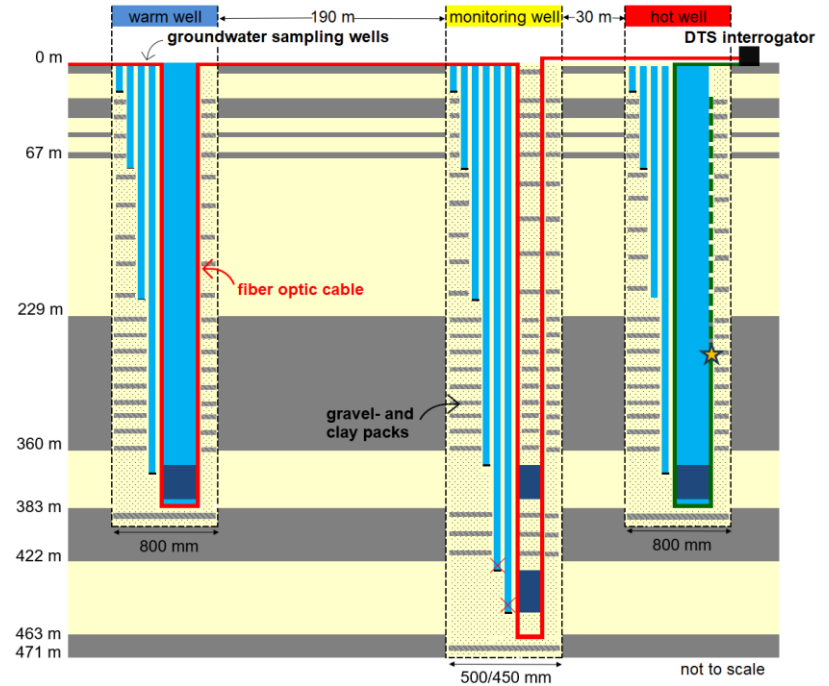
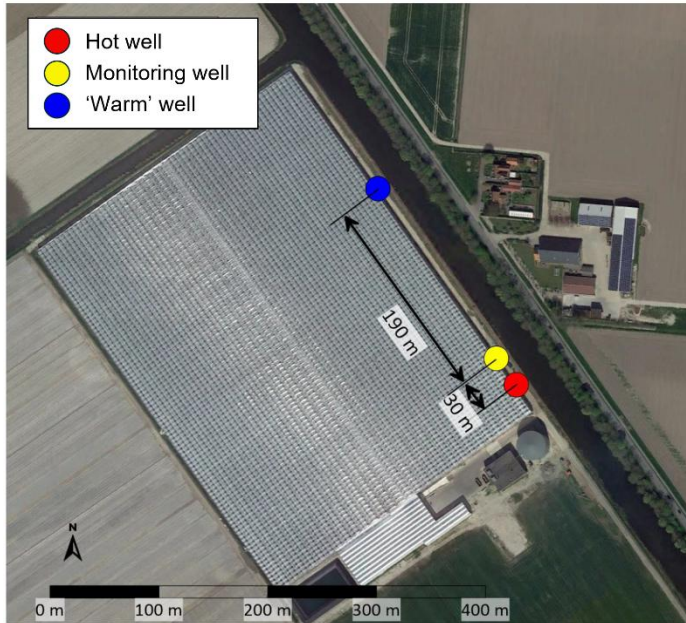
Warmtestad  
(Groningen)

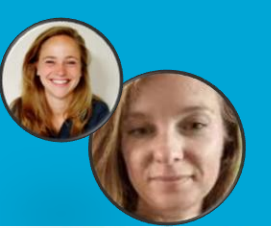
Ennatuurlijk  
Geholding B.V.  
(Middenmeer)

Dolfinarium (Harderwijk)

AVR (Duiven)

# HT-ATES Middenmeer

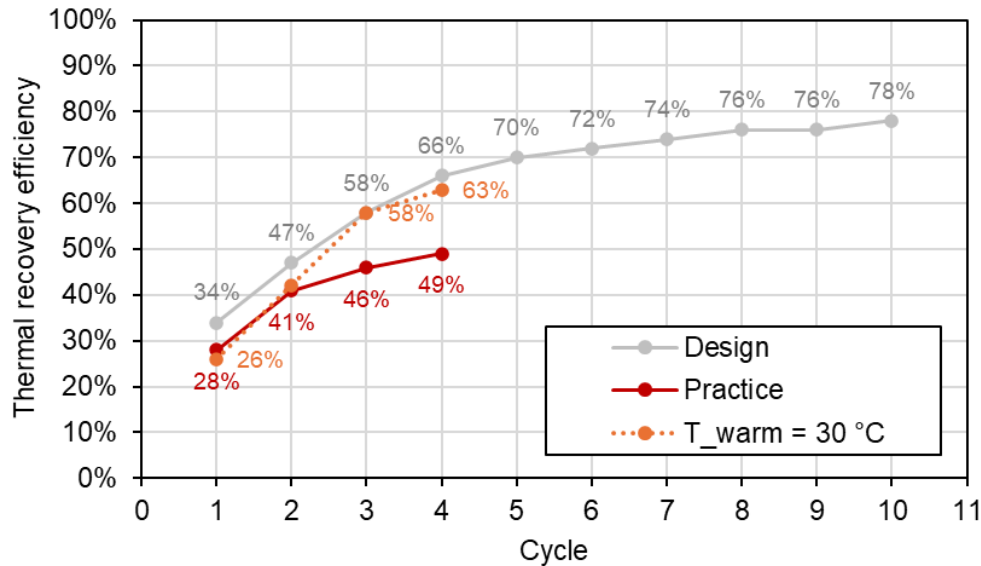




# HT-ATES Middenmeer

ennatuurlijk

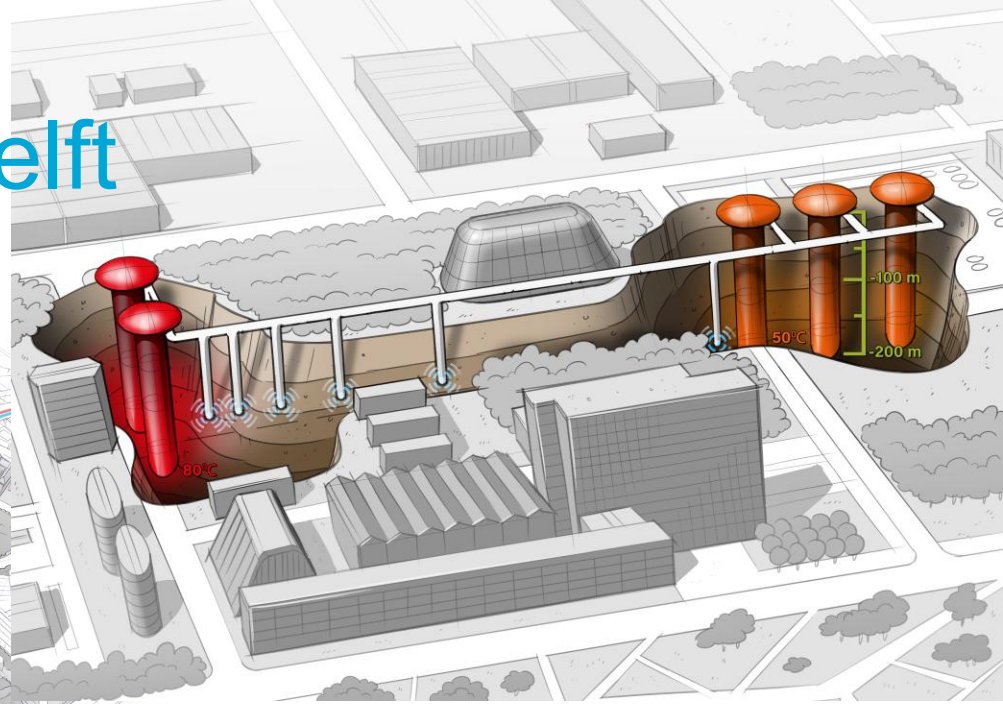
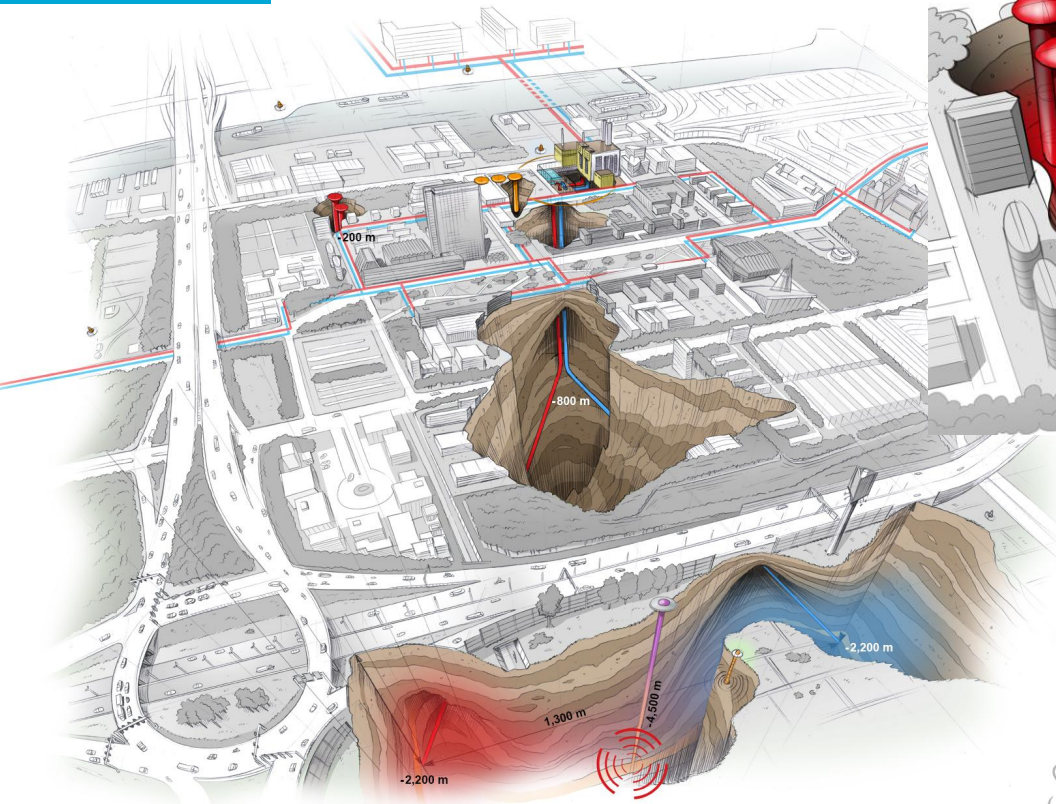
aardwarmte



TNO

TU Delft

# HT-ATES Delft



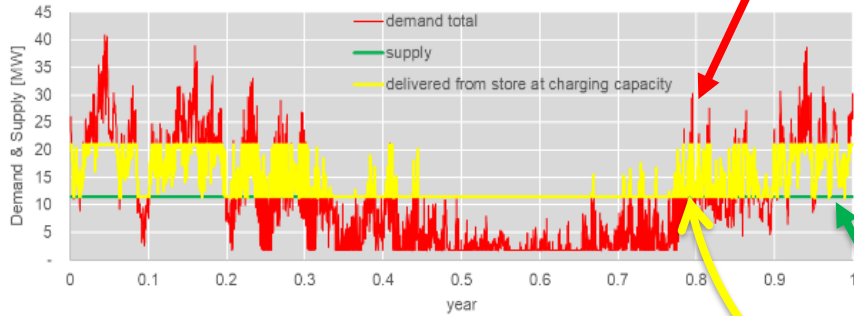
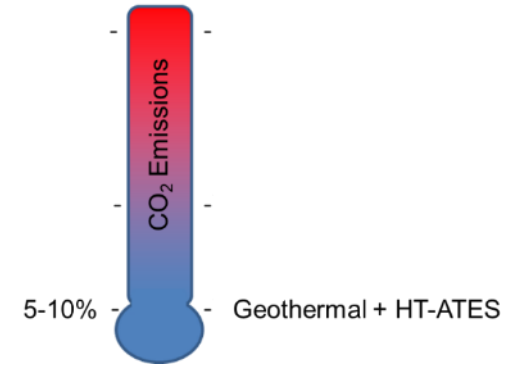
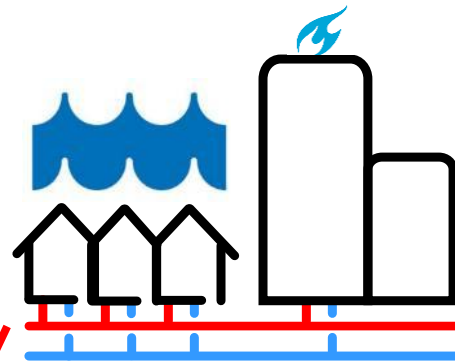
GAIA  
ENERGY

Stas

>2026

Novel combination of  
geothermal & HT-ATES

World-wide unique research &  
education infrastructure



70-90°C

Winter

HPC

At low E-price,  
additionally charge  
HT-ATES

Boiler peaks are  
much fewer

Boiler / CHP

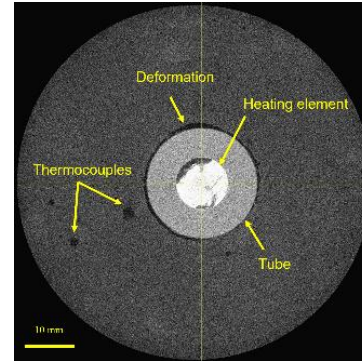
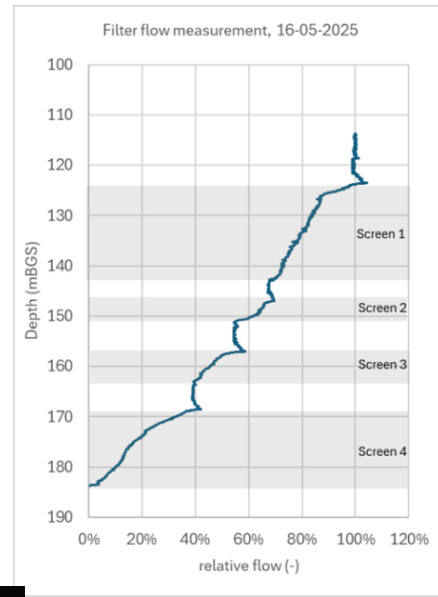
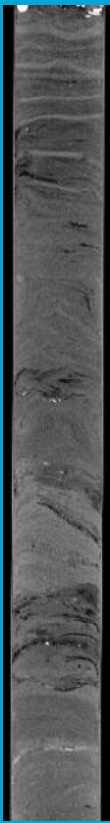
Summer

78°C  
2200 m

77-88°C  
180 m  
~400.000 m<sup>3</sup>  
~40TJ

# Innovation Highlights

1. Impact & performance
2. Wells
3. Societal
4. System integration and control



# Site Layout — monitoring network Hot wells



## Borehole legend

**F1–F9**

Fibre optic boreholes (10 confirmed)

**O1, O2**

Observation wells

**H1–H3**

Hot wells (HT-ATES)

**CF1–CF3**

CPT + DAS

**L1–L3**

Lukewarm wells

## 3 cable loops planned

**AH-DTS hot wells**

power + burial cable → housing

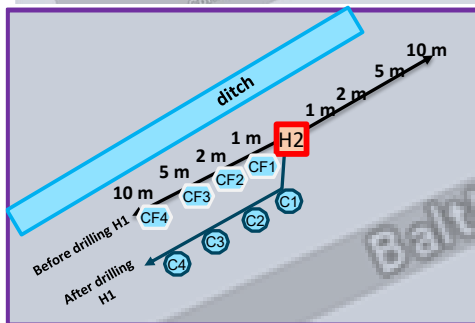
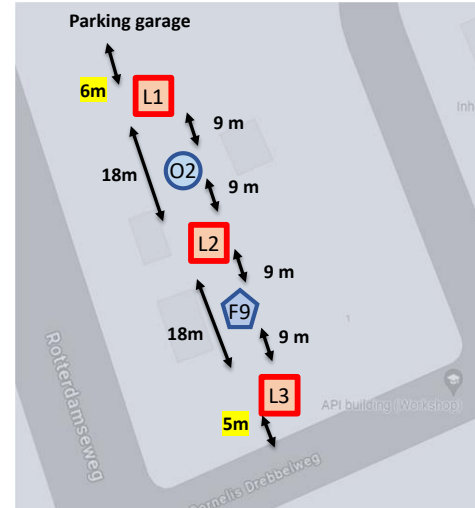
**AH-DTS lukewarm wells**

power + burial cable △ TBD

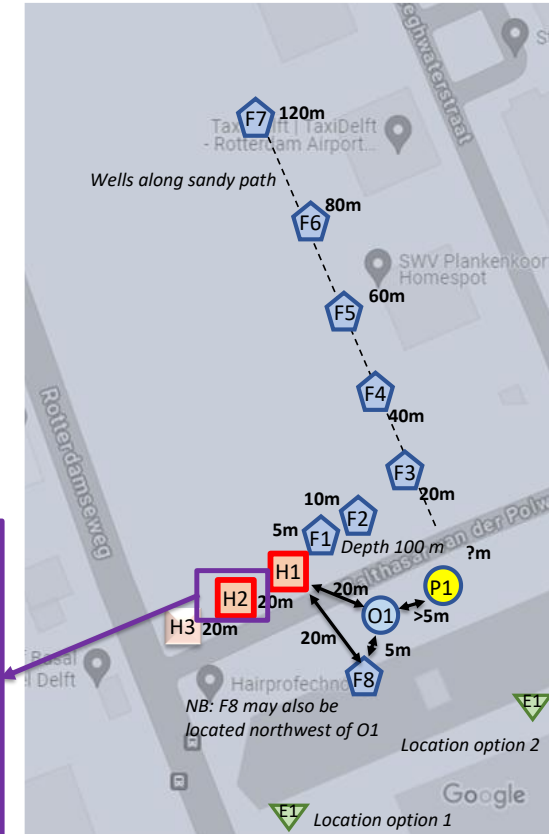
**FO: F1–F9 + O2**

fibre only → housing (1 or 2 cables)

## Warm wells

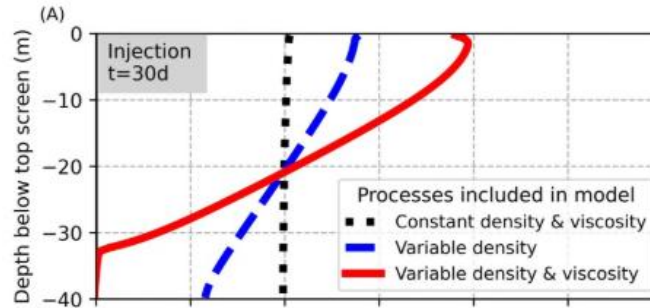
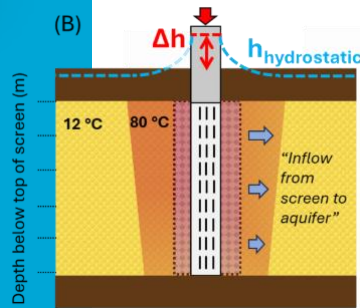


## Hot wells



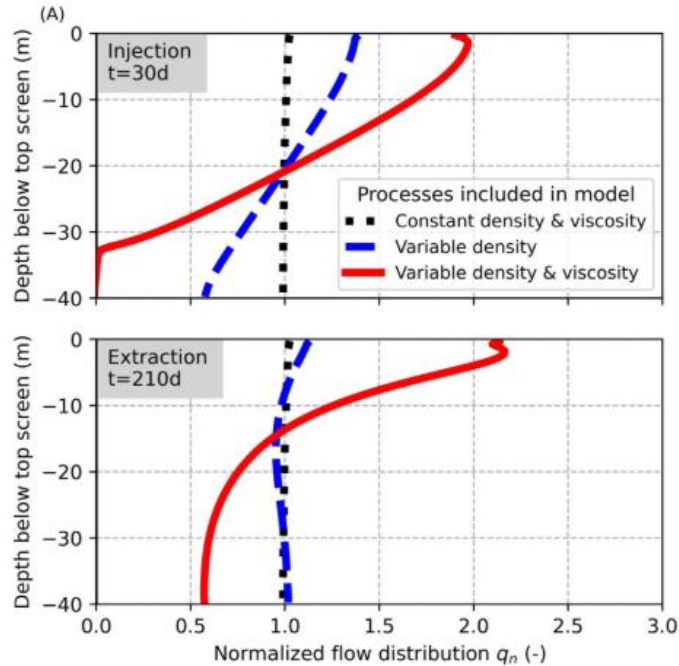
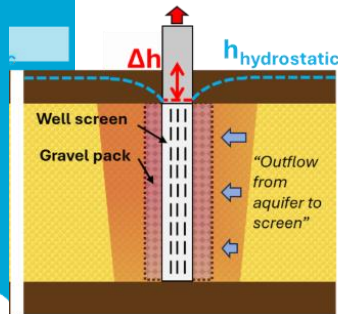
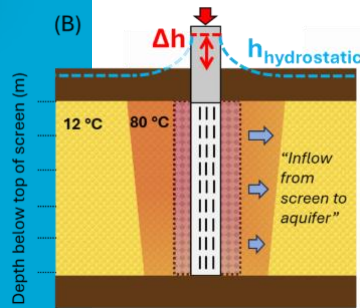


# Variable inj./ext. across screen





# Variable inj./ext. across screen

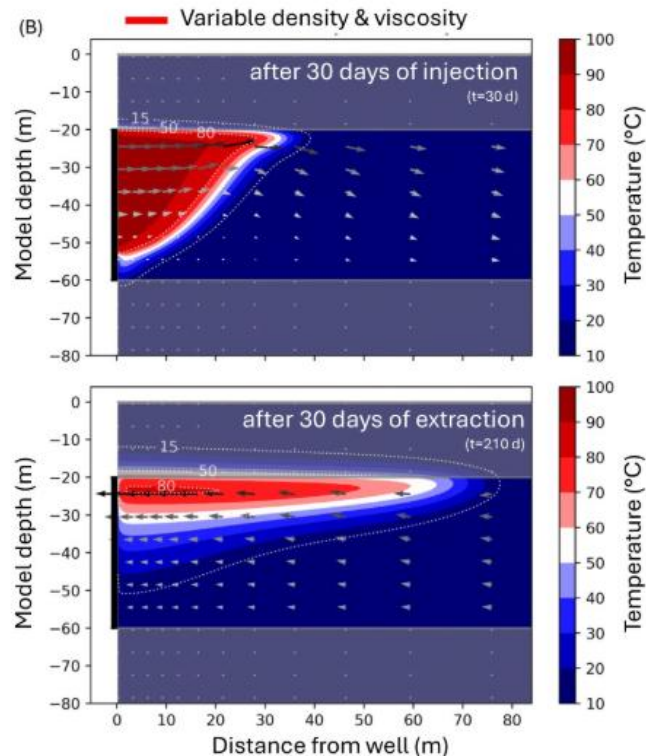
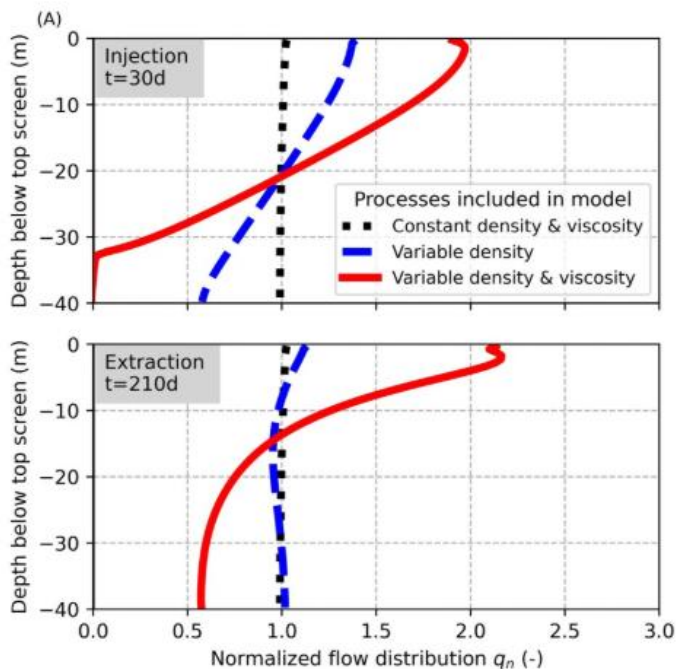
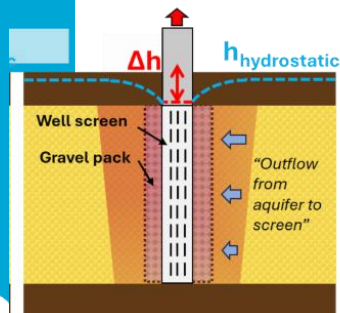
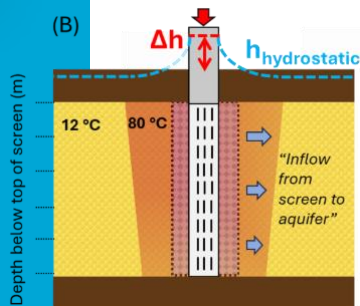


TNO

TU Delft

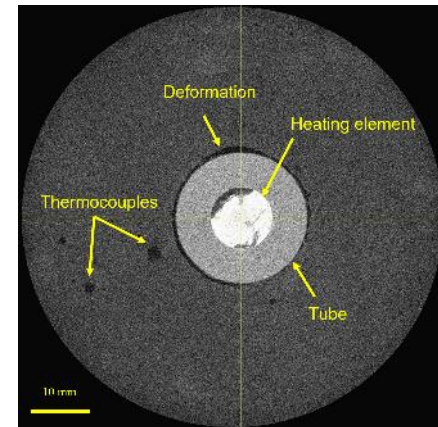
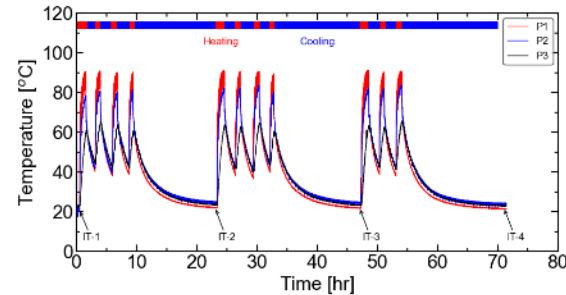
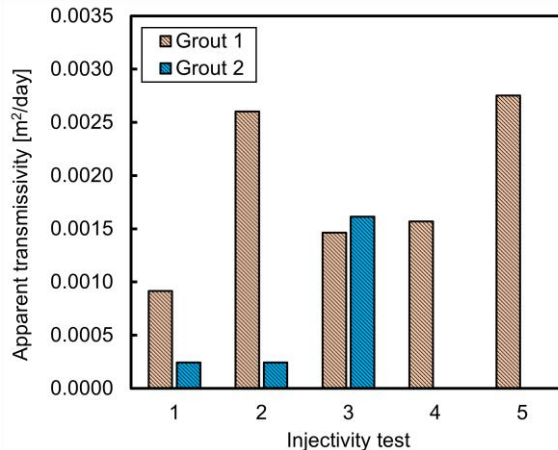
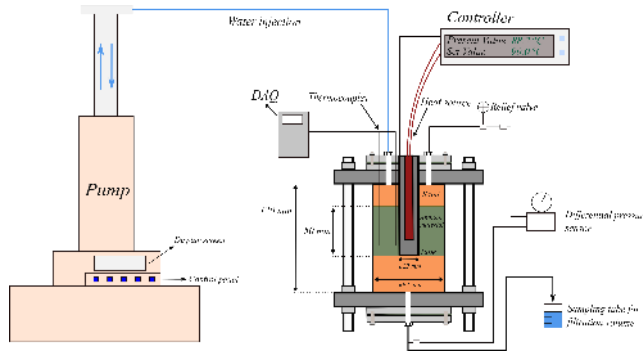
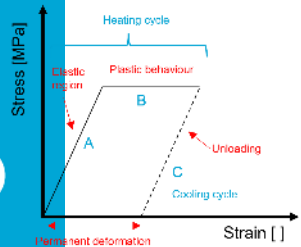
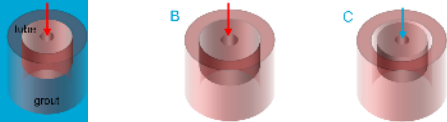
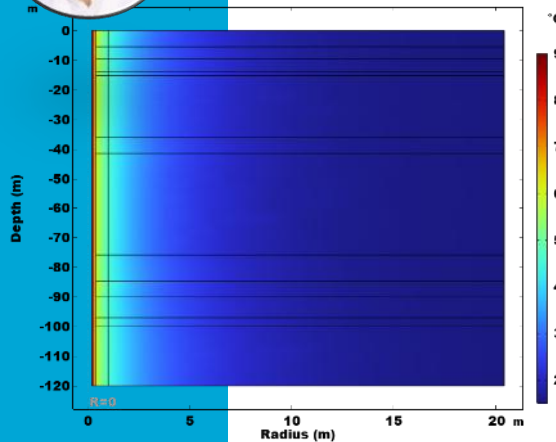


# Variable inj./ext. across screen





# Thermal Cycling Loading – Completion Material(s)



Koulidis et al. *Geothermal Energy* (2026)

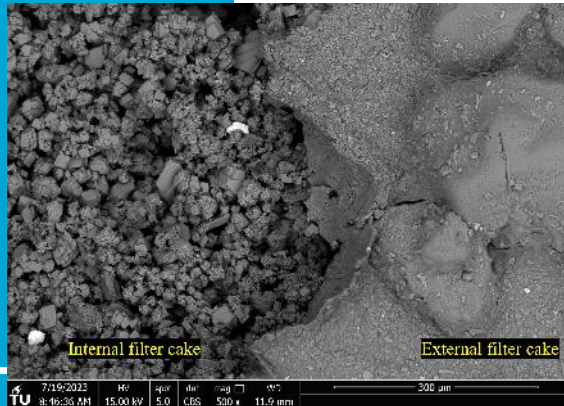
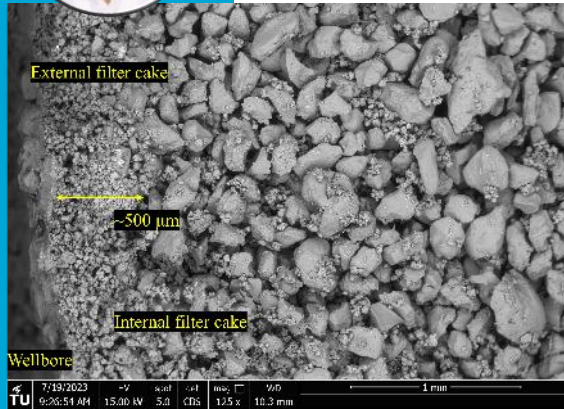
Thermal loading → mechanical stress in annular material → formation of a micro-annulus  
**Compromising the well integrity**

TNO

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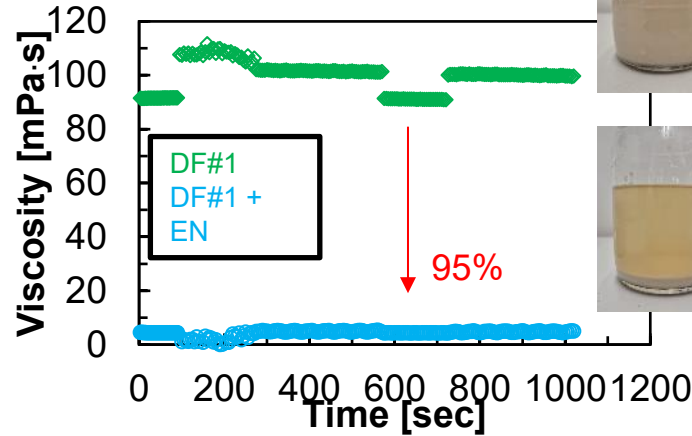


# Wellbore Strengthening and Well Development



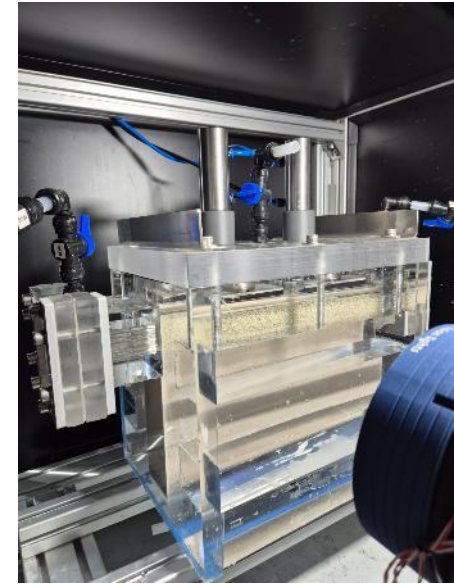
Koulidis et al. *Groundwater* (2025)

## Enzyme-triggered degradation of filter cake



### Impact:

- 100% biodegradable enzyme additives.
- Replaces harsh chemical breakers/acids.
- Reduces wellbore damage and long-term environmental risk.



- High-pressure/High-temperature custom core flooding system.
- Assess the effectiveness of drilling muds and well development methods.



# Home Smart Energy (HSE)

Geothermal heating for dense urban retrofit



## The retrofit problem

- Poorly insulated old housing stock
- Limited access for conventional GSHP drilling
- Drilling depth limited by aquifer protection
- District heating slow and expensive

## HSE in one line

*A fan of shallow diagonal boreholes drilled from a 1 m<sup>2</sup> platform in a constrained backyard — coupled to a heat pump with seasonal solar recharge.*

**Small footprint**

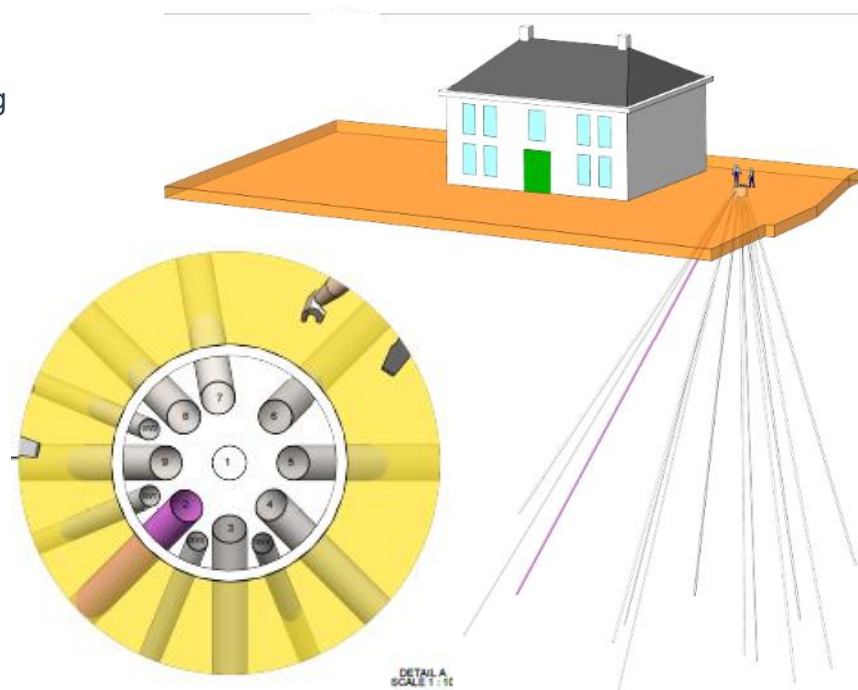
1 m<sup>2</sup> platform

**High output**

9 boreholes

**Seasonal recharge**

Solar recharge



Radial diagonal BHE array beneath an existing house.



# Home Smart Energy (HSE)

Geothermal heating for dense urban retrofit



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- Limited access for conventional GSHP drilling
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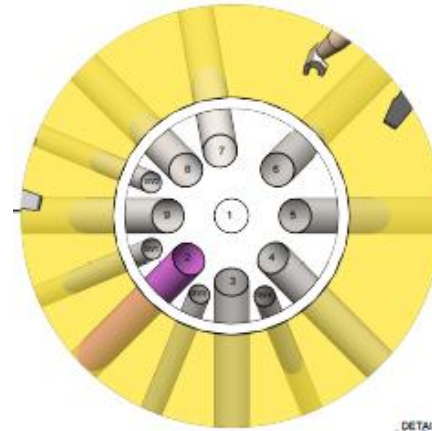
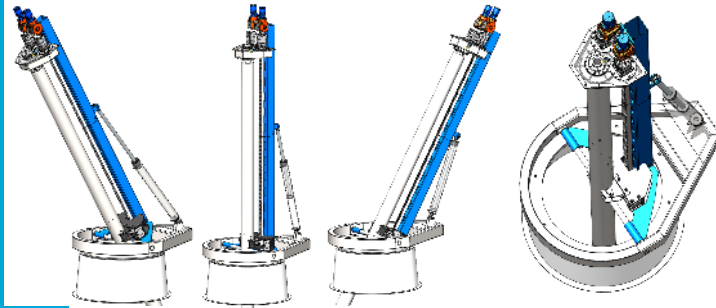
1 m<sup>2</sup> platform

High output

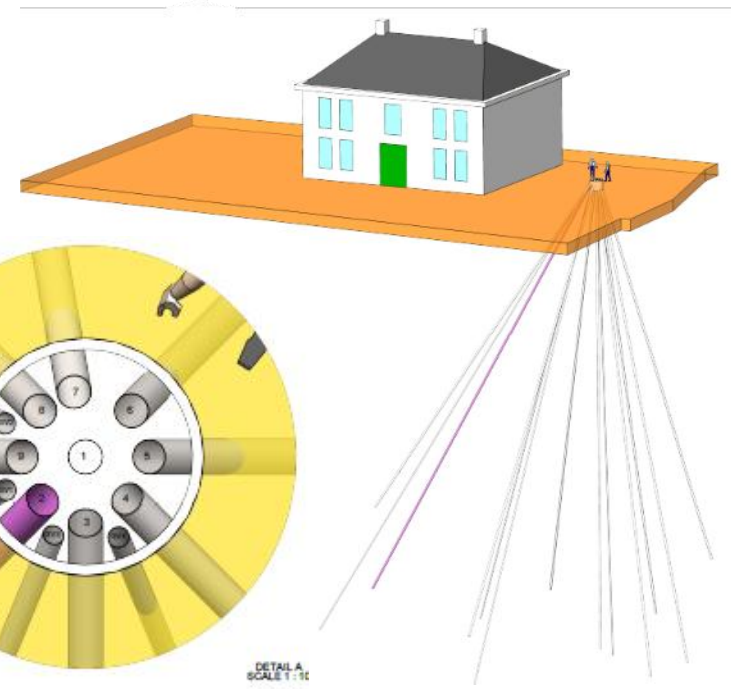
9 boreholes

Seasonal recharge

Solar recharge



DETAIL A  
SCALE 1:10



Radial diagonal BHE array beneath an existing house.

# Various other ongoing MT/HT-ATES projects

- Existing ATES → to Higher T
- ElevATES
- ACCELUTES
- WarmingUPGOO
- ..

## Various other drilling/well developments/projects

- Wells in Sulphate Reduction Transition Zone
  - Manage mitigate Clogging risks
- 3V-HTO
  - Well design standards for (HT-) ATES
- Innovative Pilot borehole
- GEO-Loop model
- Collective BTES
- Geheco

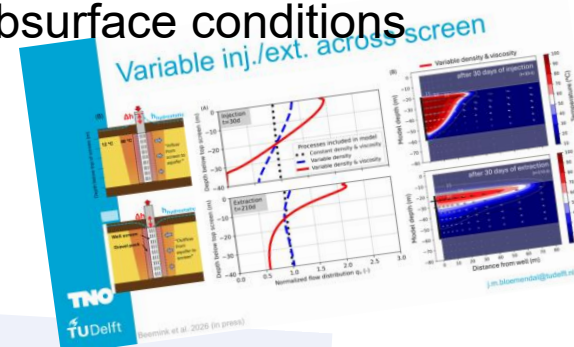
Closing and  
take home messages



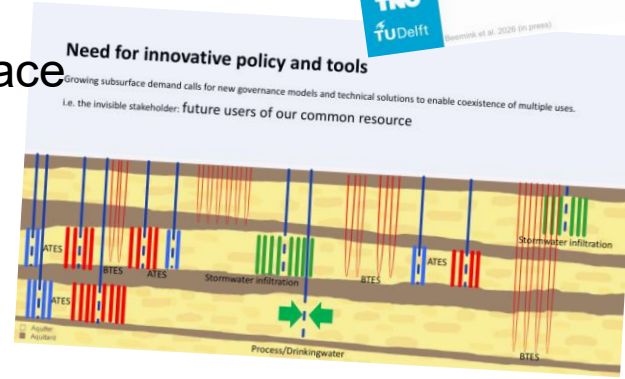
# Tipping point

Existing buildings  
More complex subsurface conditions

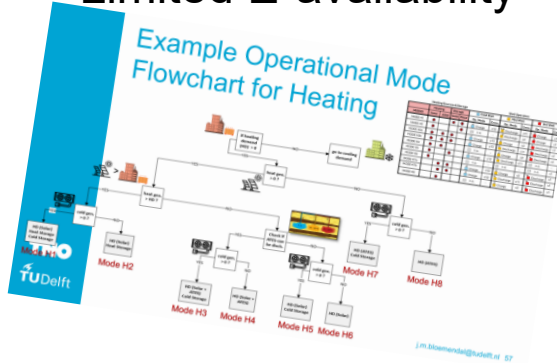
Higher temperatures  
Stronger integration



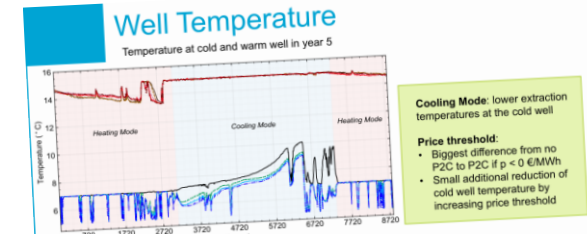
Scarcity in subsurface space



Collective systems  
Limited E-availability



Increasing cooling demand



Newly built  
Individual systems

# Take home

- Via research and demos towards cheap and robust novel UTES innovations and sustainable use of the subsurface
- Challenges for improvements/developments
  - Upscaling (temperature, placement density)
  - Integration in wider energy system / conversion / grid congestion issues
  - Performance (operational control, both HT and LT!)
  - Market conditions

| Old           | New                  |
|---------------|----------------------|
| Standalone    | <b>Integrated</b>    |
| Low-temp      | <b>Full spectrum</b> |
| Static design | <b>Adaptive</b>      |
| First-come    | <b>Coordinated</b>   |

Asjemenou

# Promotions



# UTES symposium

URBAN ENERGY SYMPOSIUM 2026

## STORING HEAT, POWERING CITIES

19 NOVEMBER 2026

THE GREEN VILLAGE, TU DELFT



REGISTER HERE

Event organised in collaboration between TU Delft Urban Energy Institute and the PUSH-IT project consortium



# MSc Sustainable Energy Technology

## Electrical Energy track



Wind Energy



Solar Energy



Waste & CHP



Energy Storage



Power Engineering



Economics & Society



Electric Mobility

## Heating and Cooling track



Heat Sources



LS Heat Systems



Heat in Buildings



Power Engineering



Economics & Society



Waste & CHP



Solar Energy



# Developing and demonstrating Underground Thermal Energy Storage Unlocking UTES for the next phase of the energy transition

Dr.ir. M. Bloemendal  
2026-06-28

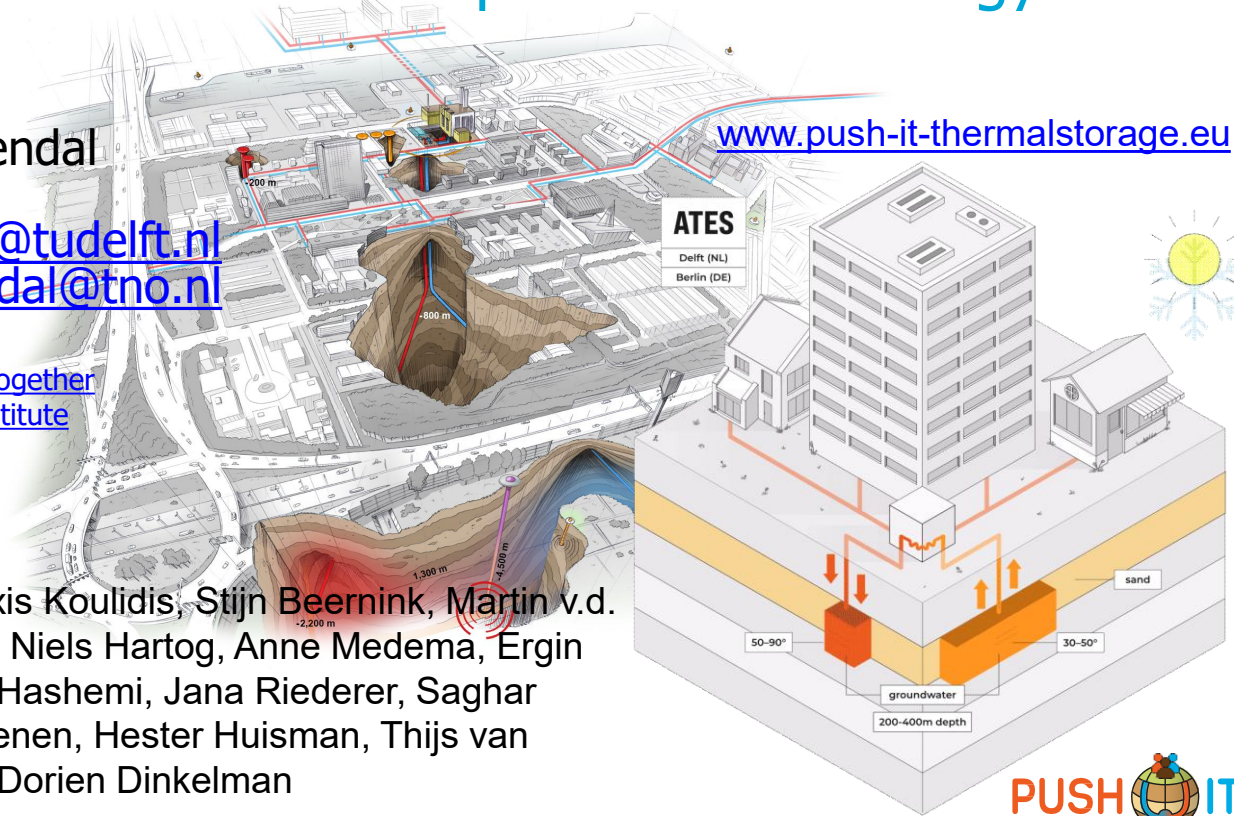
[j.m.bloemendal@tudelft.nl](mailto:j.m.bloemendal@tudelft.nl)  
[martin.bloemendal@tno.nl](mailto:martin.bloemendal@tno.nl)

Stay in touch / connect?

[TU Delft geothermal get together](#)  
[TU Delft Urban energy institute](#)  
[Delft Aardwarmte project](#)

Contributions from:

Tessel Grubben, Alexis Koulidis, Stijn Beernink, Martin v.d. Schans, Phil Vardon, Niels Hartog, Anne Medema, Ergin Kukrer, Amirhossein Hashemi, Jana Riederer, Saghar Sarshar, Marielle Koenen, Hester Huisman, Thijs van Esch, Rik Molenaar, Dorien Dinkelman



# Novel combination of geothermal & HT-ATES in complex energy system

World-wide unique infrastructure for research & education

Delft (subsurface) urban energy laboratory

Making the energy transition happen

