Developing and demonstrating HT-Aquifer Thermal Energy Storage in Delft

Dr.ir. M. Bloemendal

UTES symposium
2025-10-06

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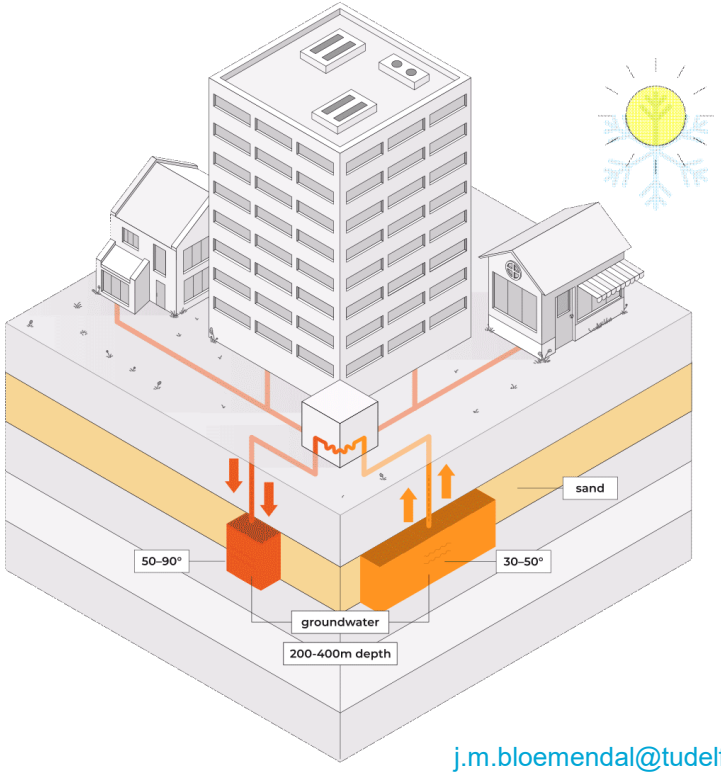

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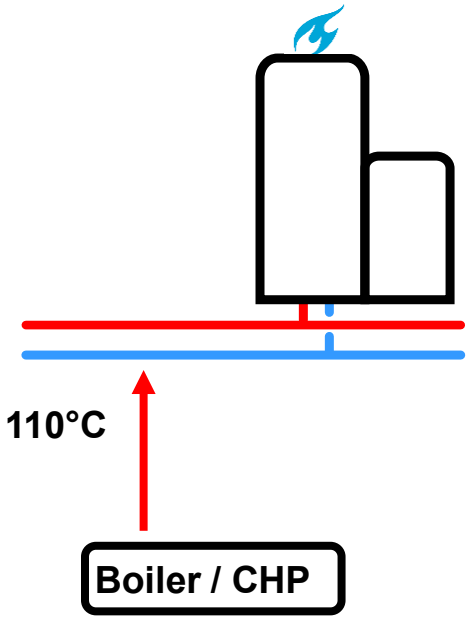
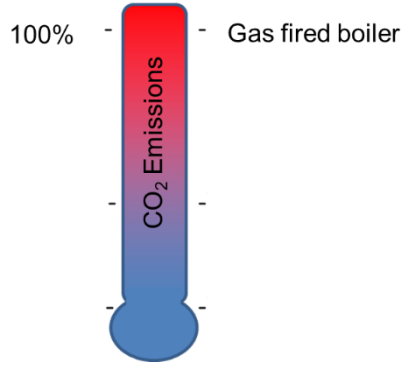
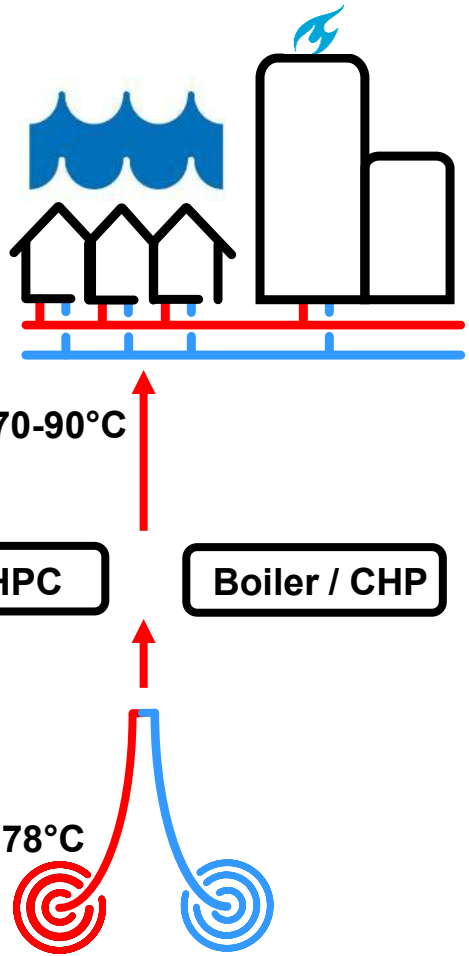
Current





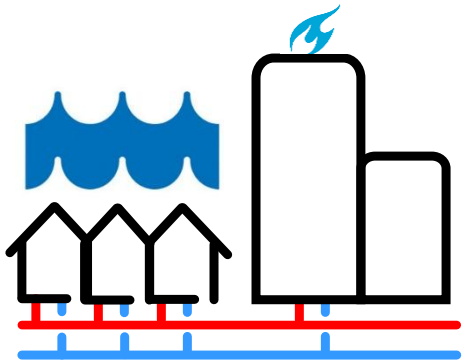
>2025



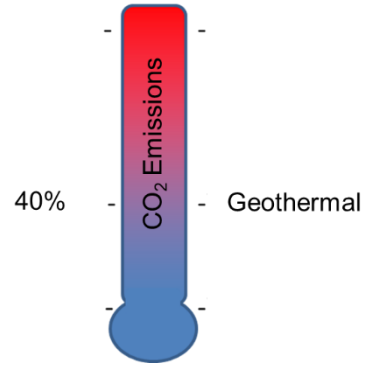
Tuesday session 2F

www.Geothermiedelft.nl

>2025



Also deliver to city



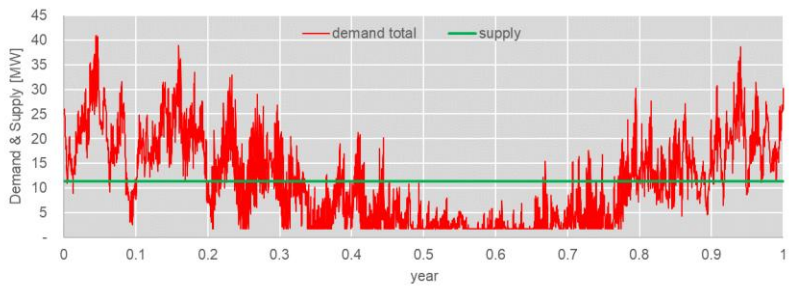
70-90°C

Heat pump to
Maximise power
Minimise injection temp

HPC

Boiler / CHP

Backup for peaks



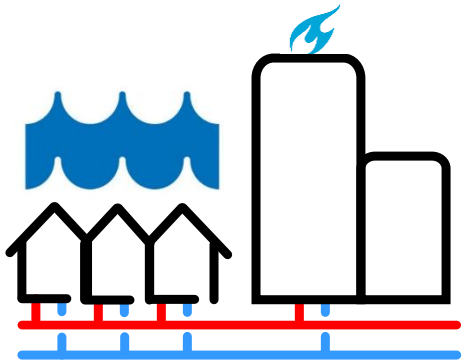
79°C

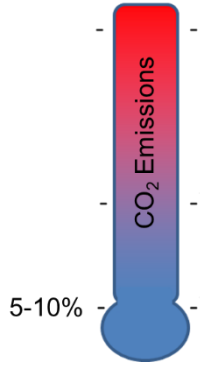
~2026

Novel combination of geothermal & HT-ATES

World-wide unique research & education infrastructure

Thursday Poster session





70-90°C

Winter

Boiler peaks are much fewer

Boiler / CHP

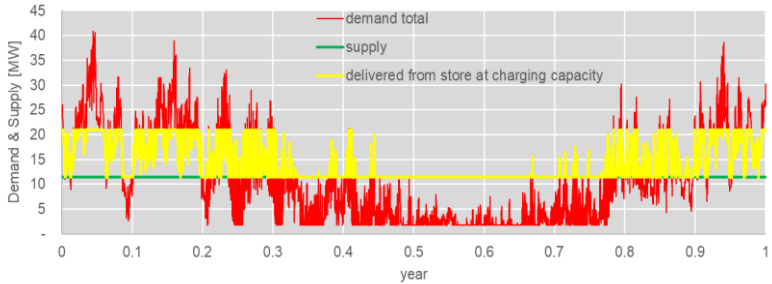
HPC

At low E-price, additionally charge HT-ATES

Summer

77-88°C
~200m
~40 TJ
~500,000 m³

78°C
~2200m

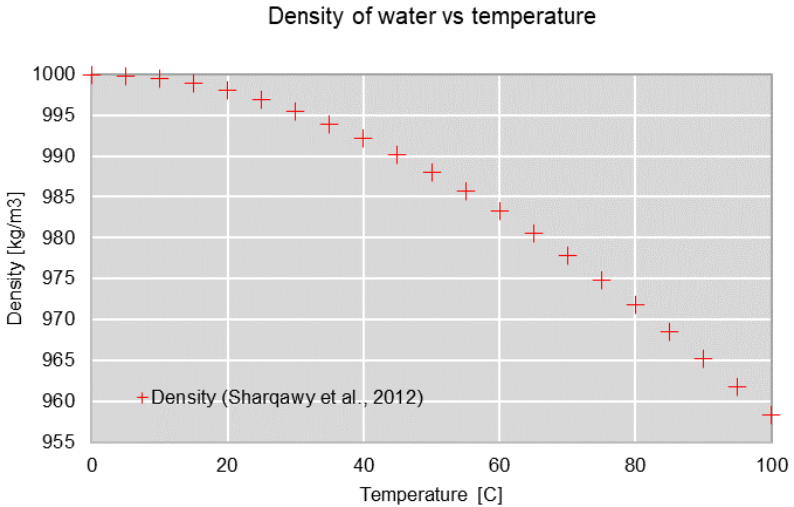


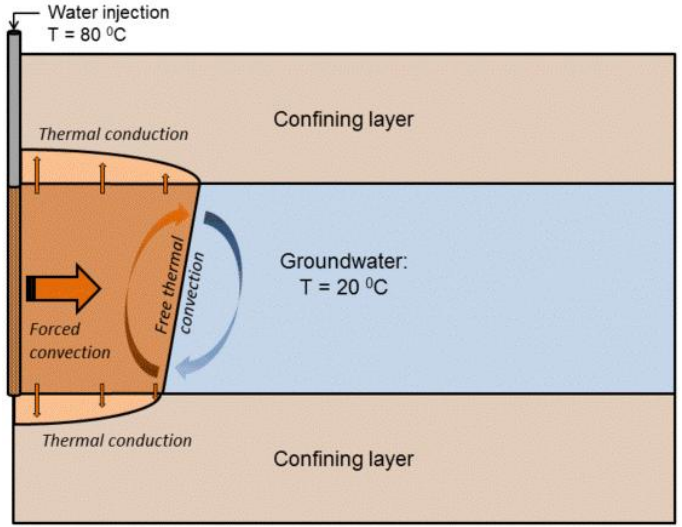
PUSH IT

Innovation Highlights

1. Impact & performance

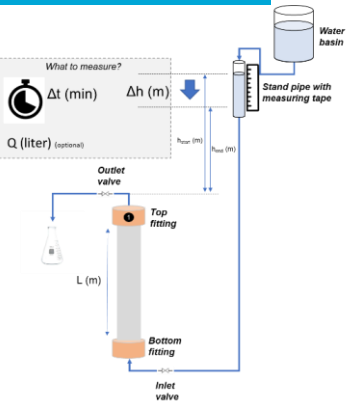
- Heat distribution / losses
- Aquifer characterisation

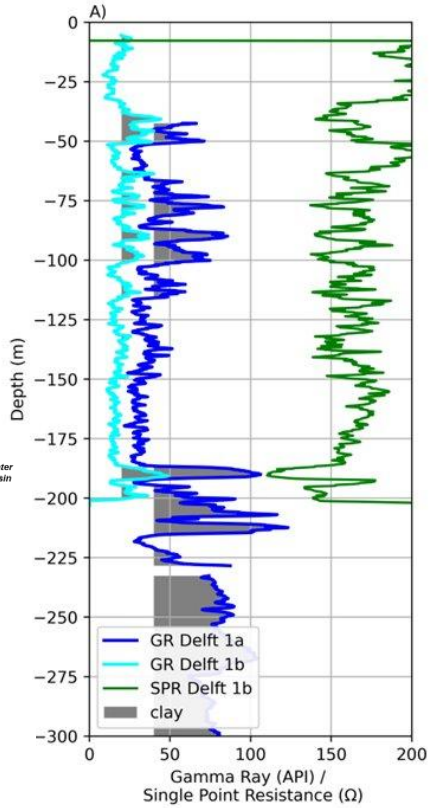


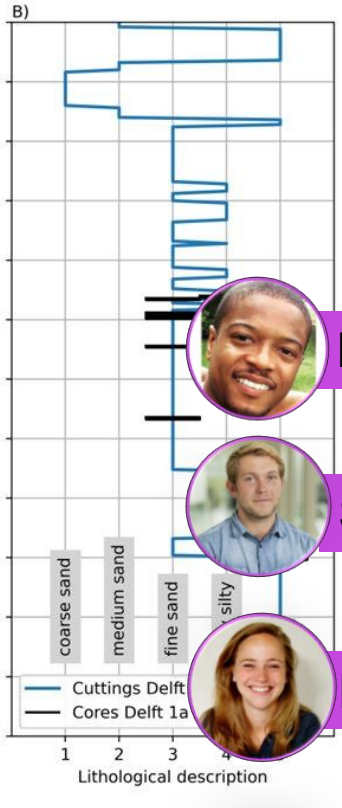


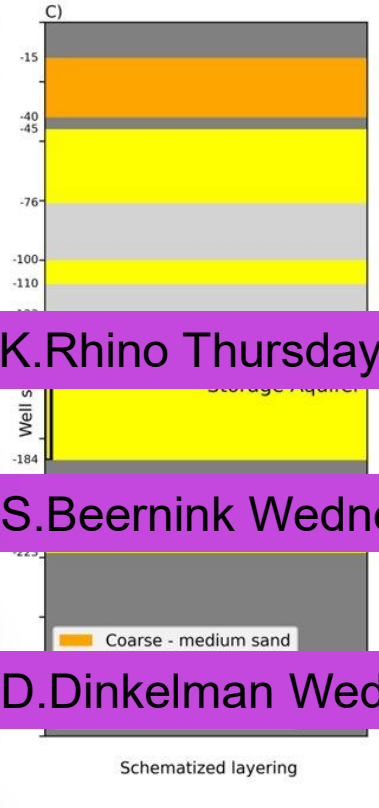
Lopik, J. H. v., N. Hartog and W. J. Zaadnoordijk (2016). "The use of salinity contrast for density difference compensation to improve the thermal recovery efficiency in high-temperature aquifer thermal energy storage systems." Hydrogeology Journal.

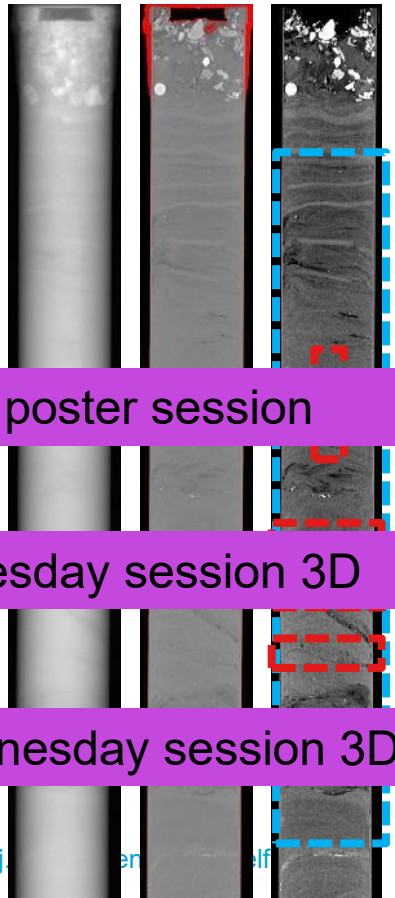
subsurface analysis and tests









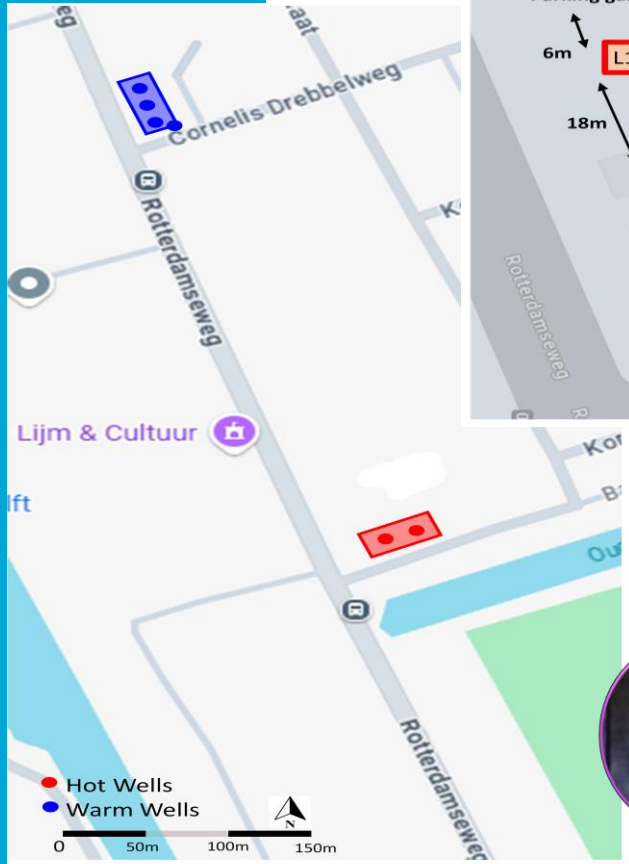


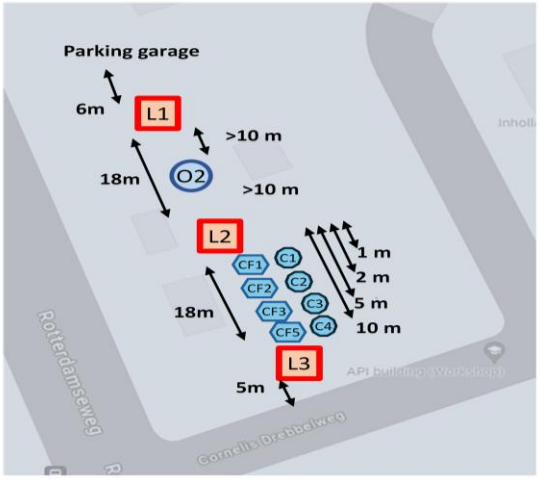
K.Rhino Thursday poster session

S.Beernink Wednesday session 3D

D.Dinkelman Wednesday session 3D

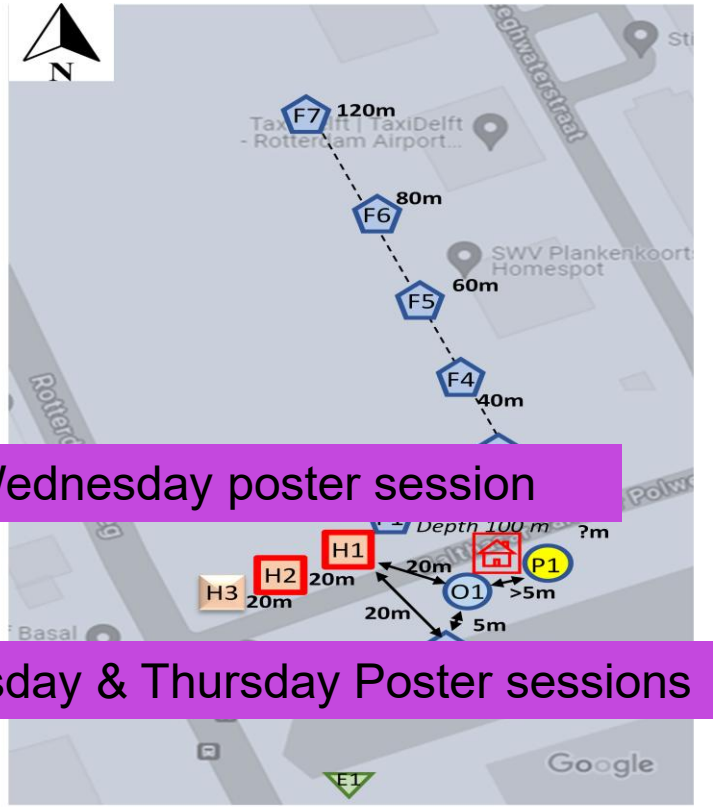
Dense temperature monitoring network





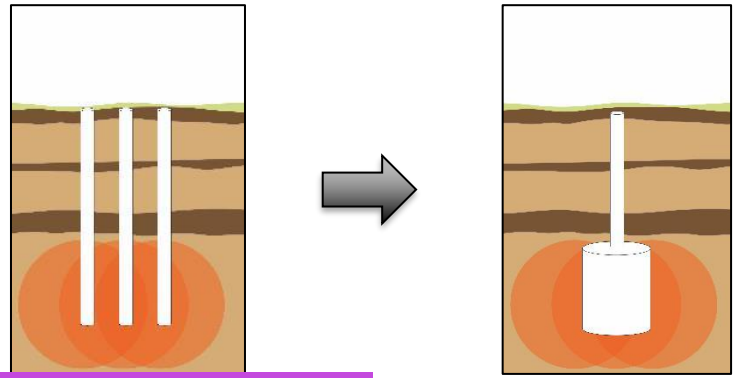
E.d.Vries Wednesday poster session

A.Hashemi Wednesday & Thursday Poster sessions



Innovation Highlights

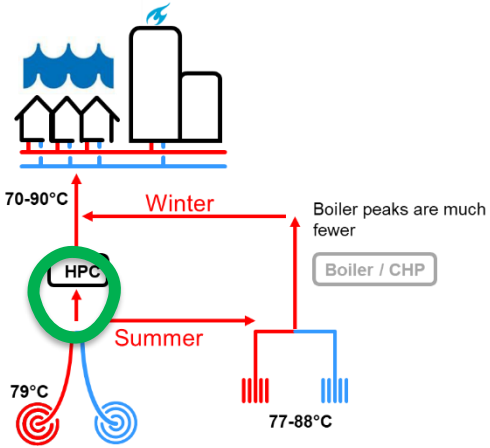
1. Impact & performance
   - Heat distribution / losses
   - Aquifer characterisation
2. Wells
   - Drilling method
   - Completions



A.Koulidis Tuesday Poster session

Innovation Highlights

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



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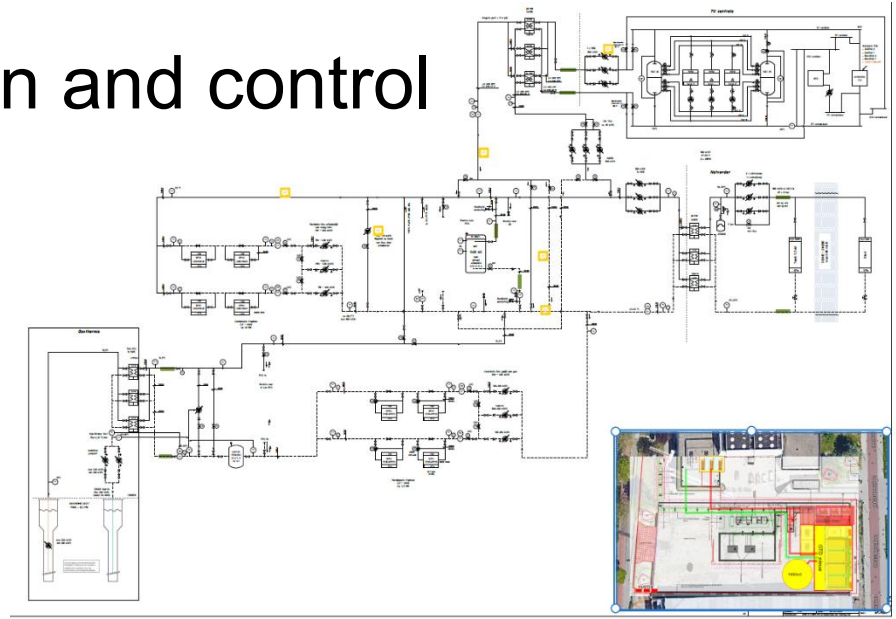
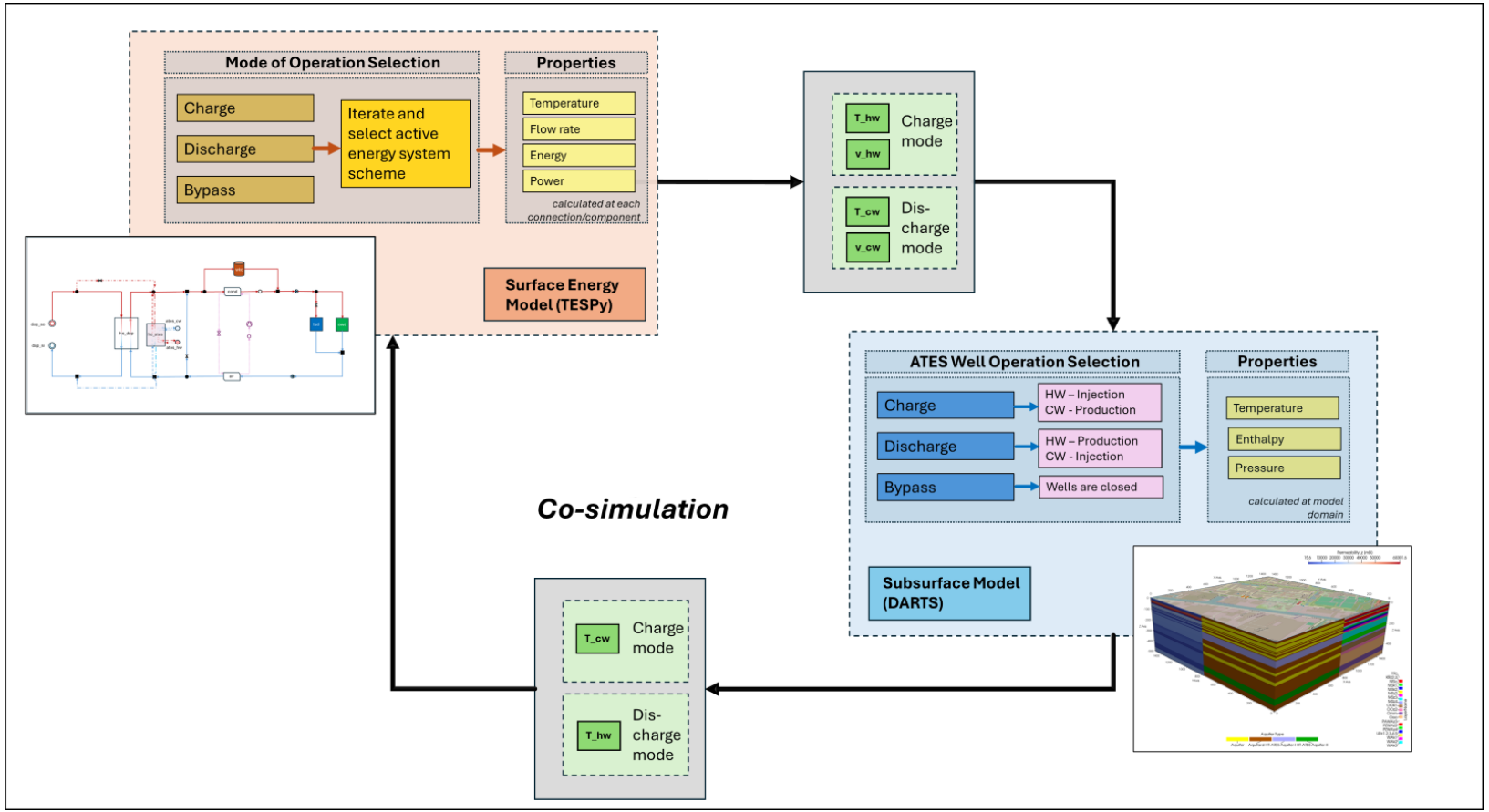
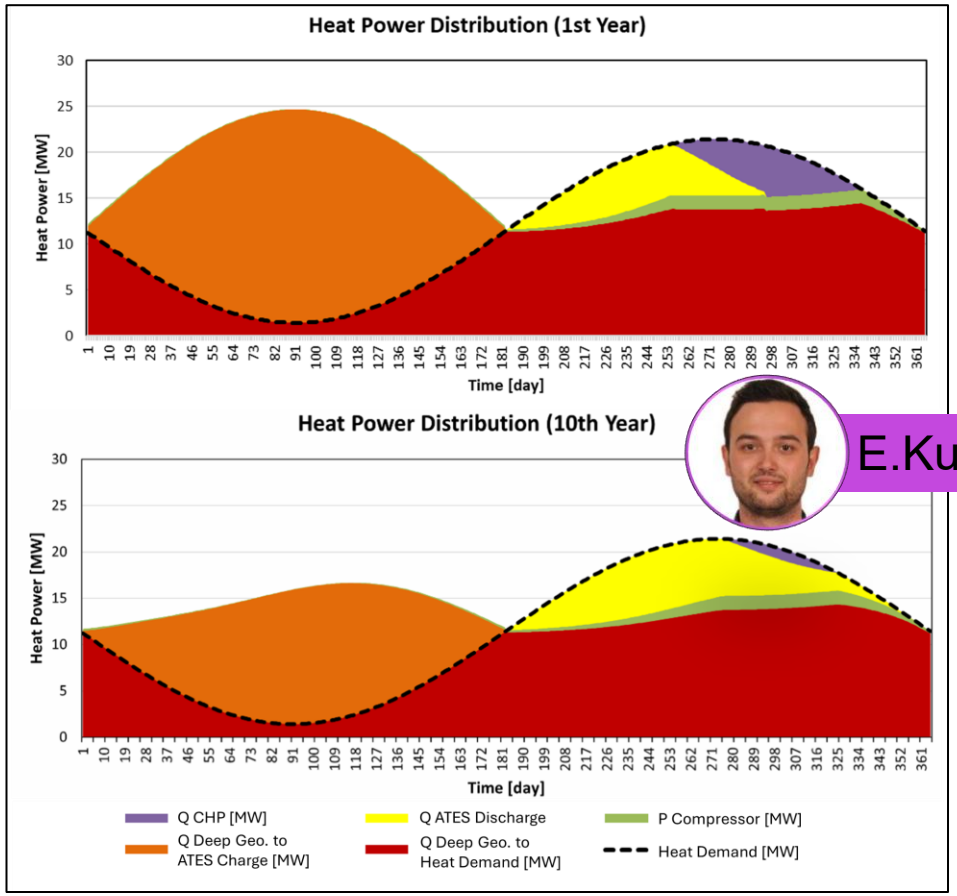
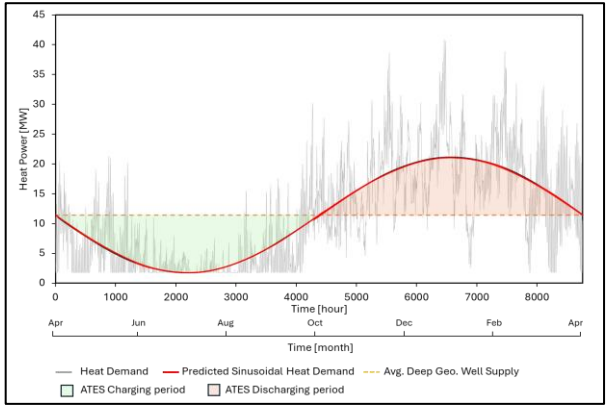


System integration and control



System integration and control

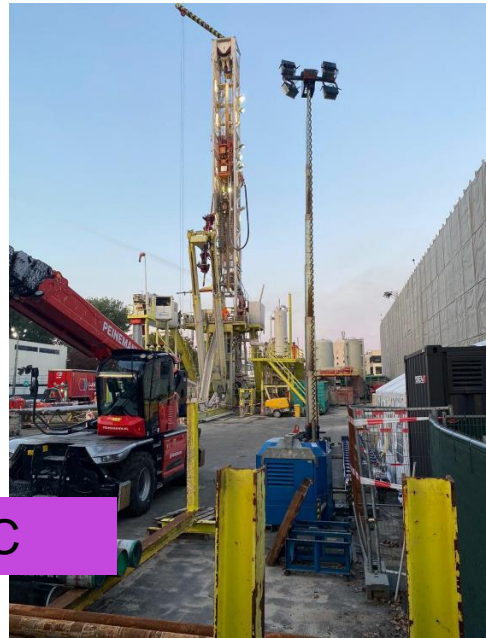




E.Kukrer Tuesday Poster session

Innovation Highlights

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



M.Kechagia Wednesday session 3C

Status

- Geothermal start delivering heat winter ’25/’26
- HT-ATES wells drilled early 2026 → charge summer 2026

Lessons so-far

- HT-ATES Helps: Renewable share exceeds 95% by Year 10
- UTES is not "just" an add-on: technical and organisational integration is challenging. Demand conditions determine
- Gradual stabilisation of the ATES performance affects operation
- Dynamic cut-off strategy enhances ATES performance.
- Many novel insights into:
  - Well drilling: why are open boreholes stable?
  - Completion materials
  - Integration & control strategies
  - Aquifer characteristics

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Developing and demonstrating HT-Aquifer Thermal Energy Storage in Delft

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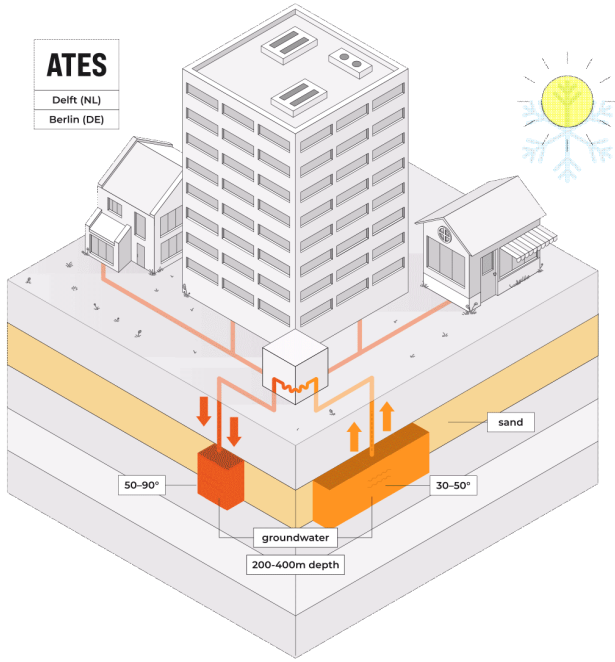
PUSH IT

www.push-it-thermalstorage.eu

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

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Back-up

Main drivers for ATES adoption in NL

1. Building energy performance regulation
2. Standards & quality
   a) Wells
   b) Surface plant

3. Planning and permitting of ATES wells

In busy areas: possibility to plan
Certification requirement
Reporting & enforcement of performance
Extensive research to effects

HT-ATES legality in NL

- <25°C standard regulatory framework
- >25°C Permitted by provincial board (GS)
  often as pilot / research projects