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Opportunities and challenges for large scale HT-ATES systems (PPT)

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Publication date

2019

Document Version

Final published version

Citation (APA)

Bloemendal, M. (2019). *Opportunities and challenges for large scale HT-ATES systems (PPT)*. DAP symposium 2019, Delft, Netherlands.

Important note

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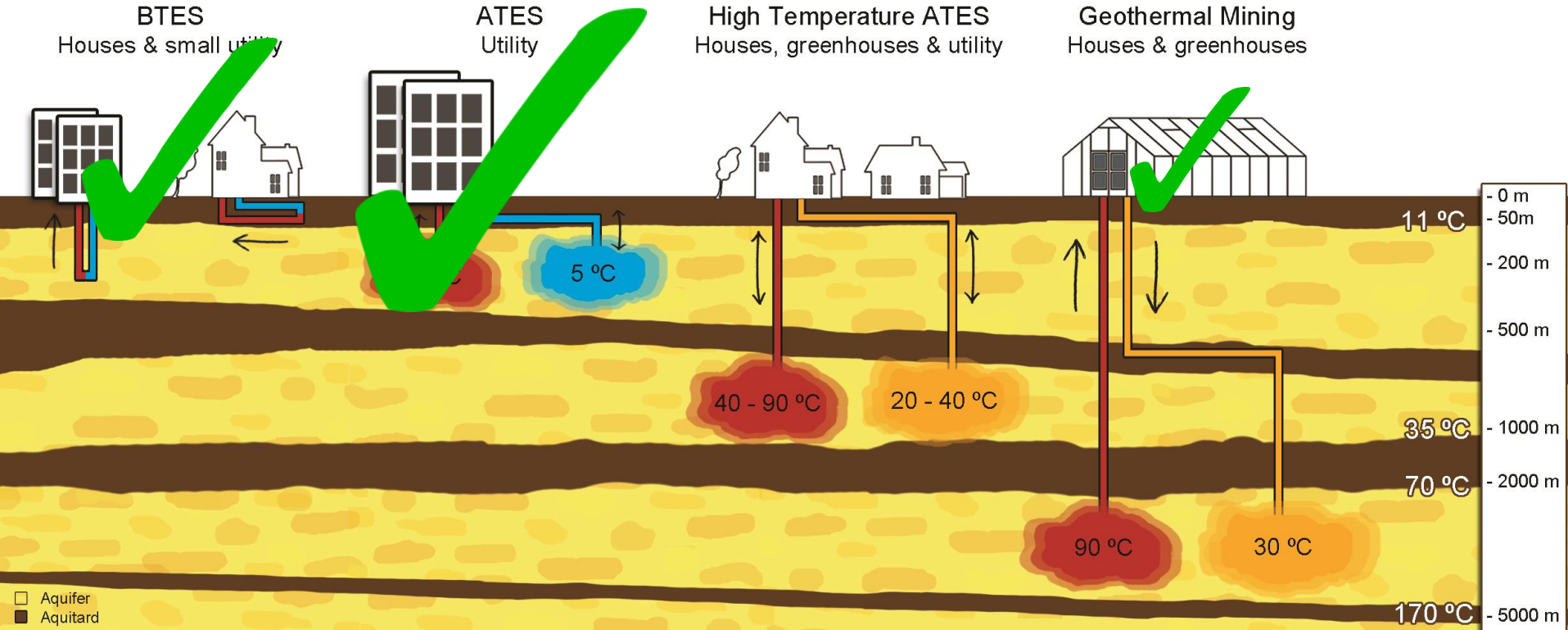
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Opportunities and challenges for large scale HT-ATES systems

Martin Bloemendal
2019-03-12



Geothermal Energy in NL





Netherlands & Belgium



China & Japan



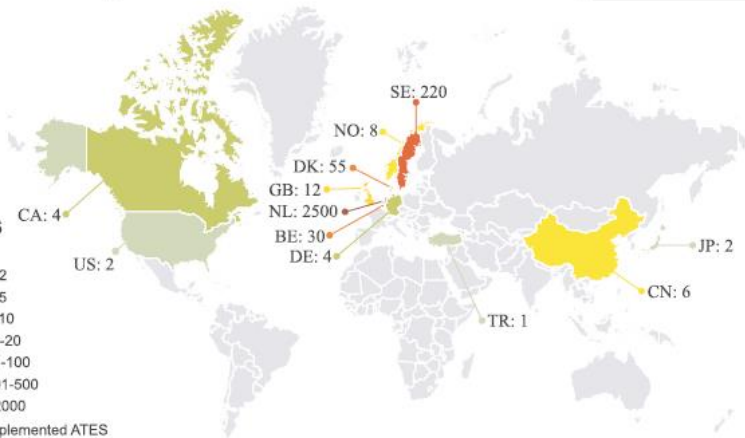
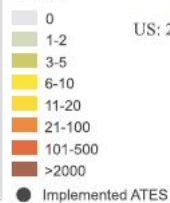
Denmark



Great Britain



ATES



Sweden & Norway



North America



Germany

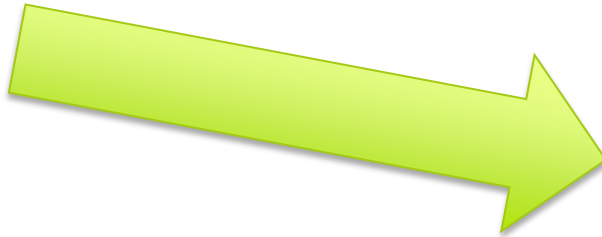


Turkey

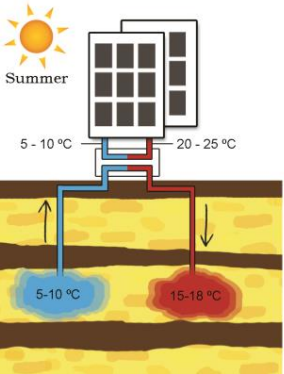
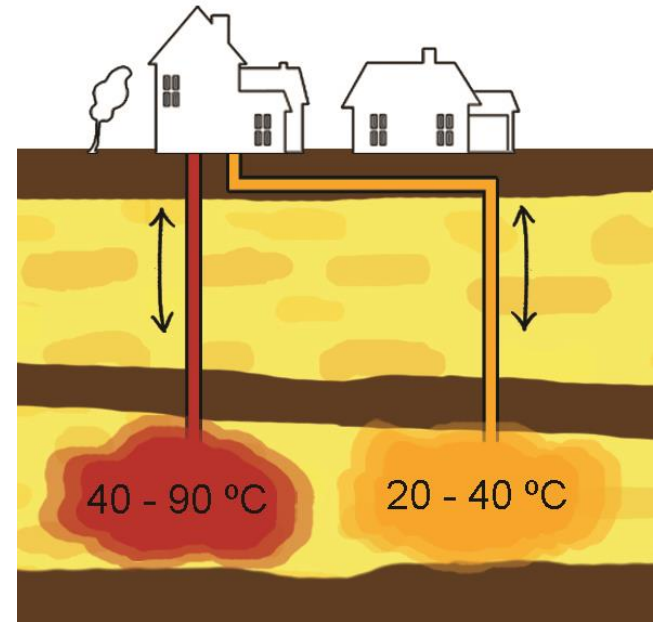


HT-ATES

- $>25^{\circ}\text{C}$
- Currently permitted as “pilot-projects”

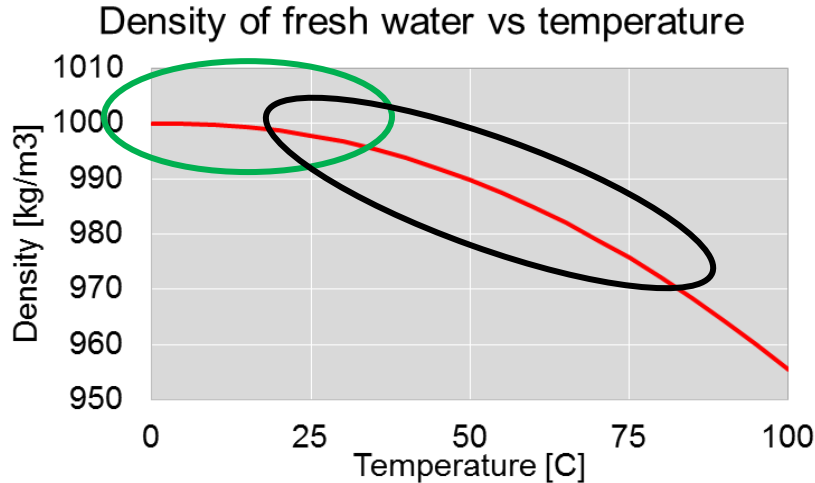


High Temperature ATES
Houses, greenhouses & utility

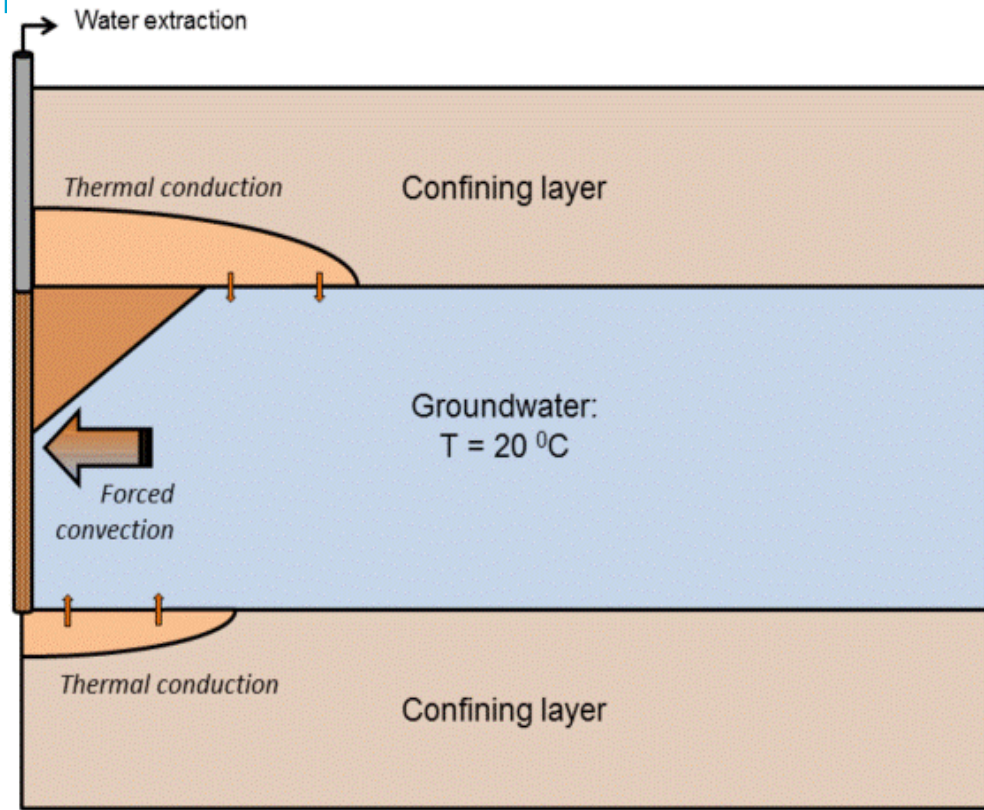
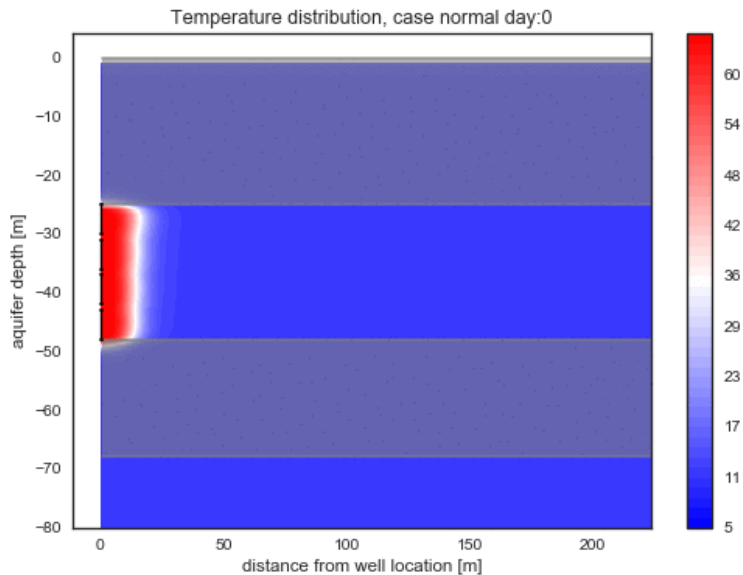


Challenges

- Chemical & micro biological effects
- Clogging e.g. Deposition of CaCO_3
- Buoyancy flow



HT-ATES → Buoyancy



Multi partially penetrating wells

Freshwater surplus:

ASR Well

Basin

Greenhouse

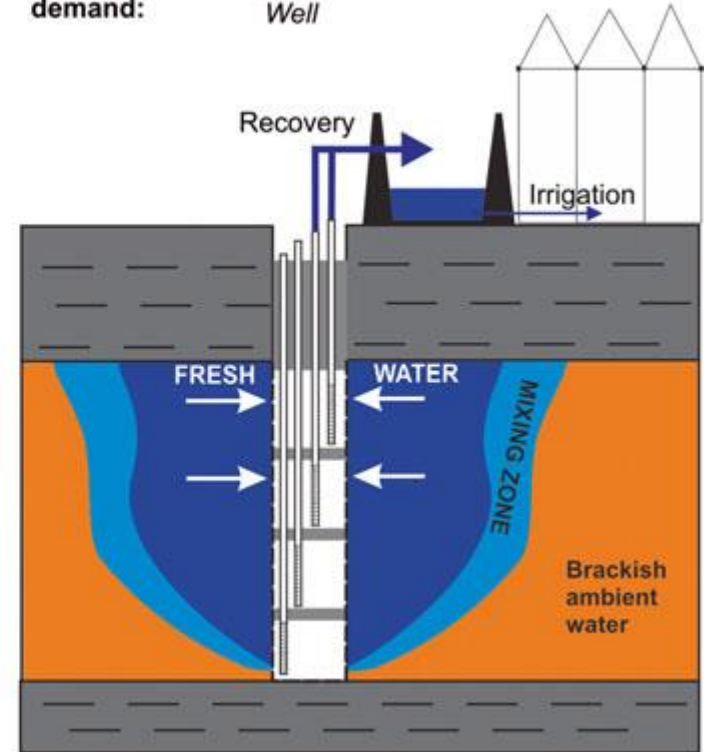
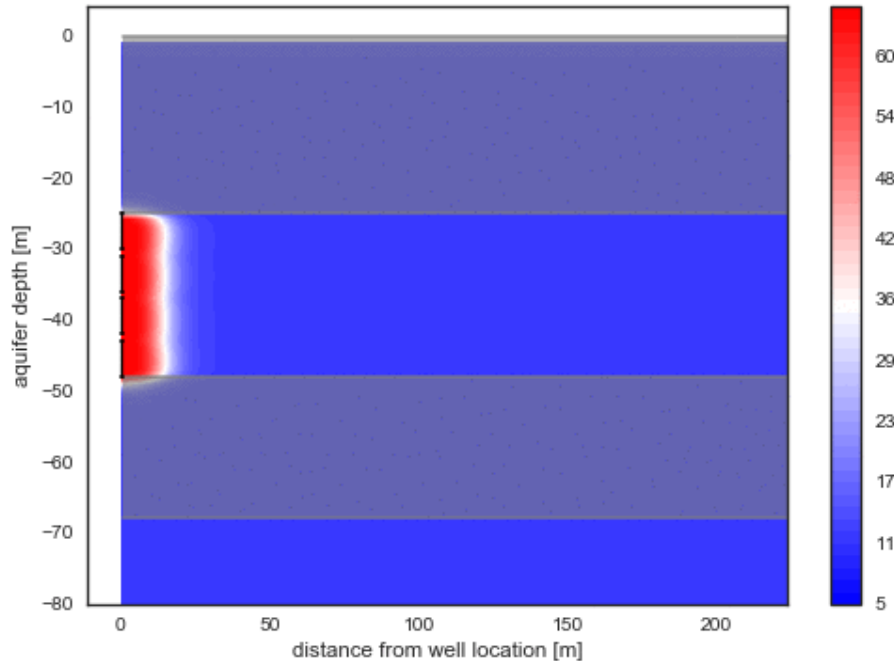


Freshwater demand:

ASR Well

Basin

Greenhouse

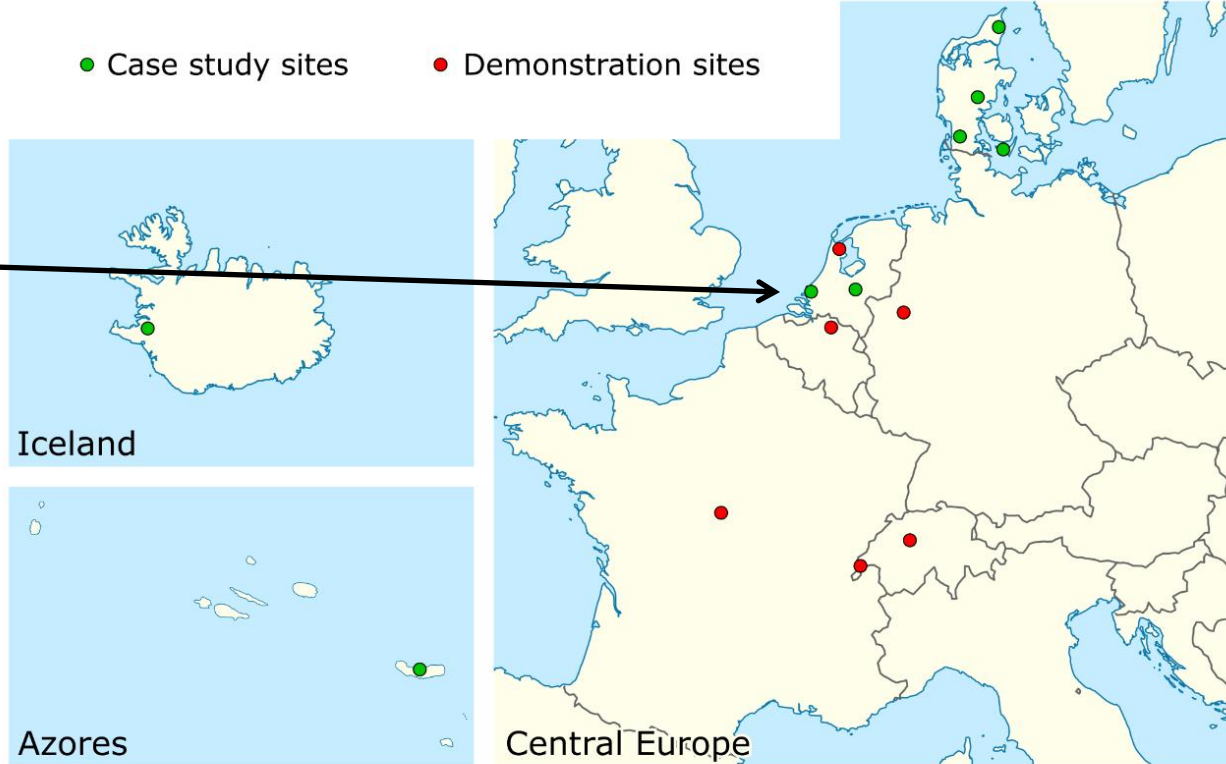


Effects
Efficiency
GW-quality

HEATSTORE (geothermica funding)

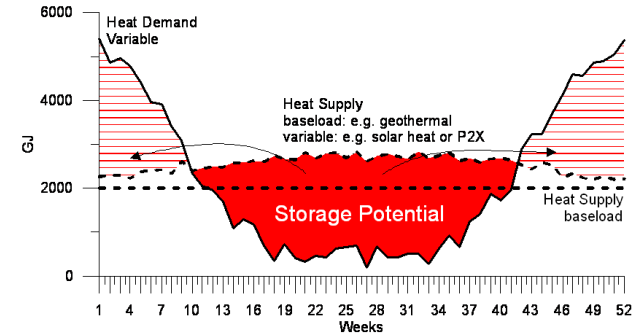
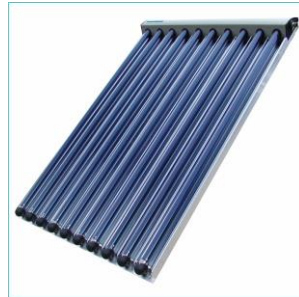
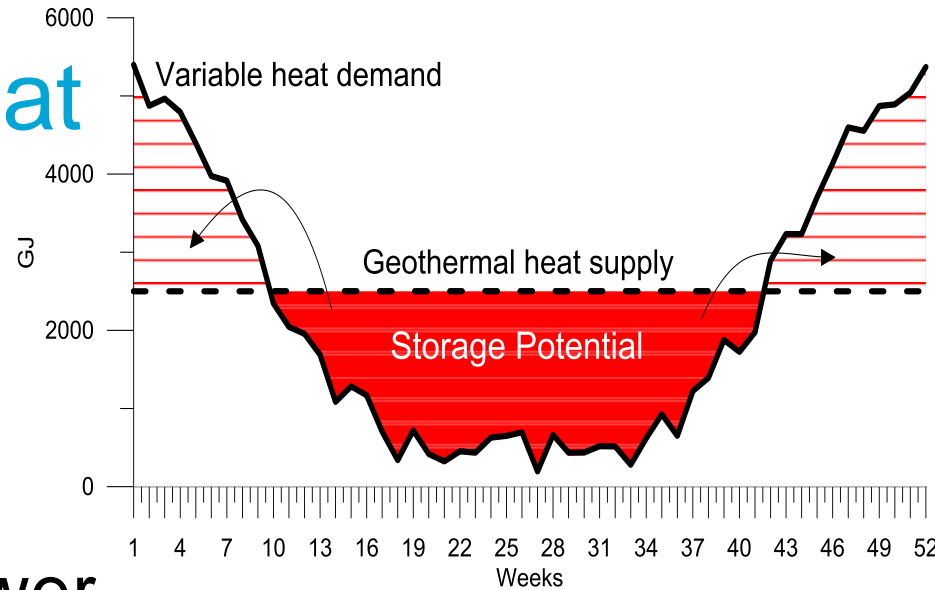
EGC 19
field-trip

● Case study sites ● Demonstration sites



Sources of heat

- Geothermal
- Waste heat
- Solar heat
- Solar / wind power

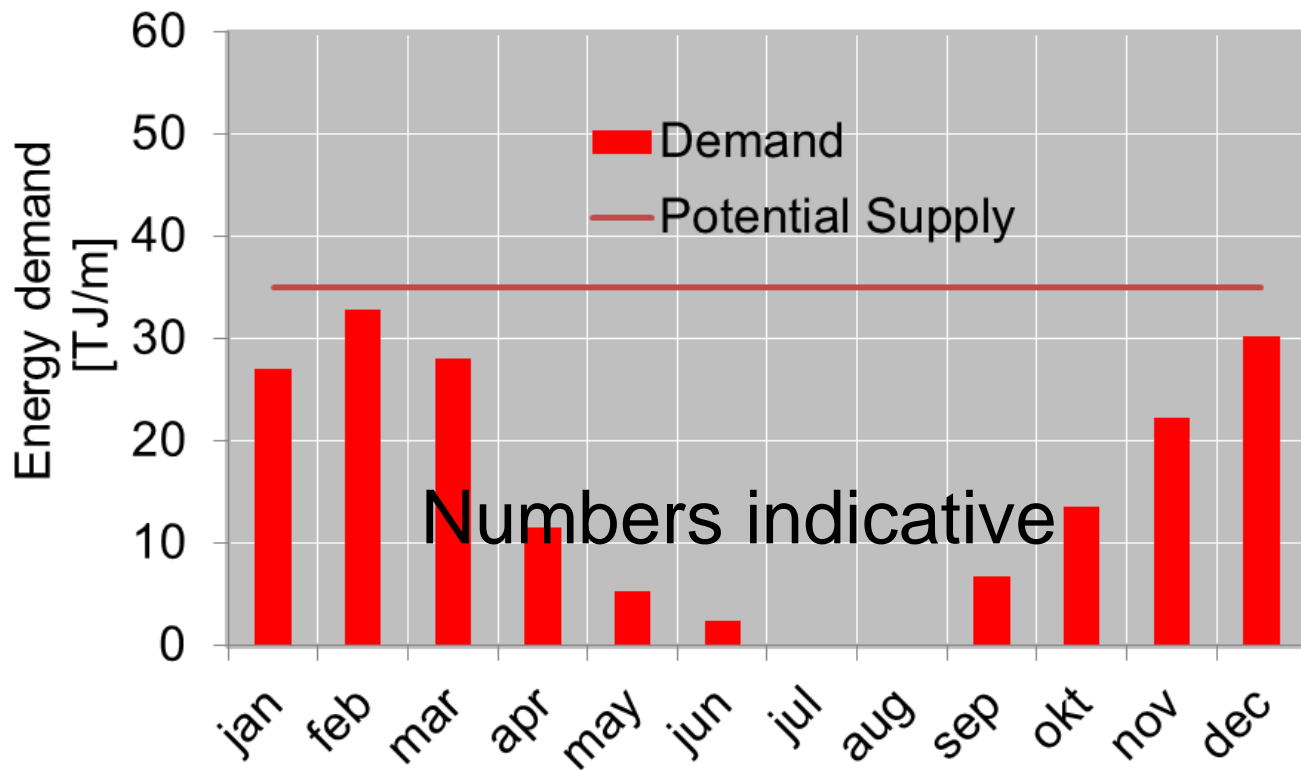


Demand:
180 TJ/y

Direct from
DAP-well :
180TJ/y

Potential
DAP well:
>400TJ/y
(p50)

HT-ATES @ TUDelft



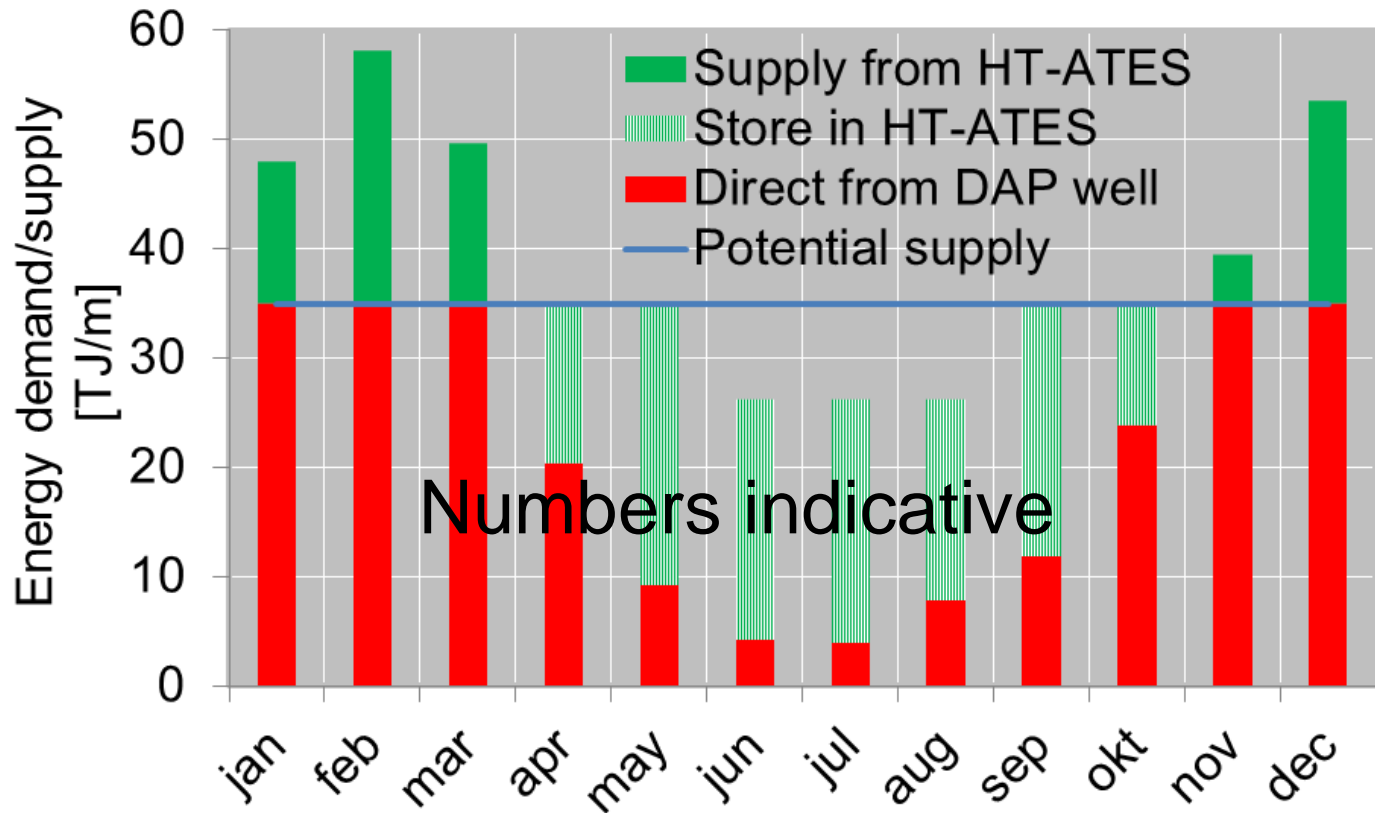
Add 15,000
houses to
Demand:
330 TJ/y

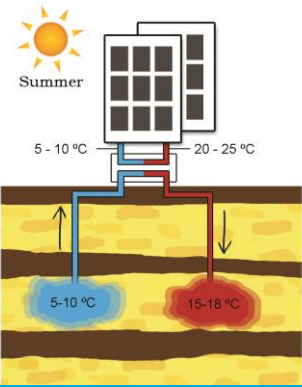
BACK-UP/
redundancy

Store:
~100TJ

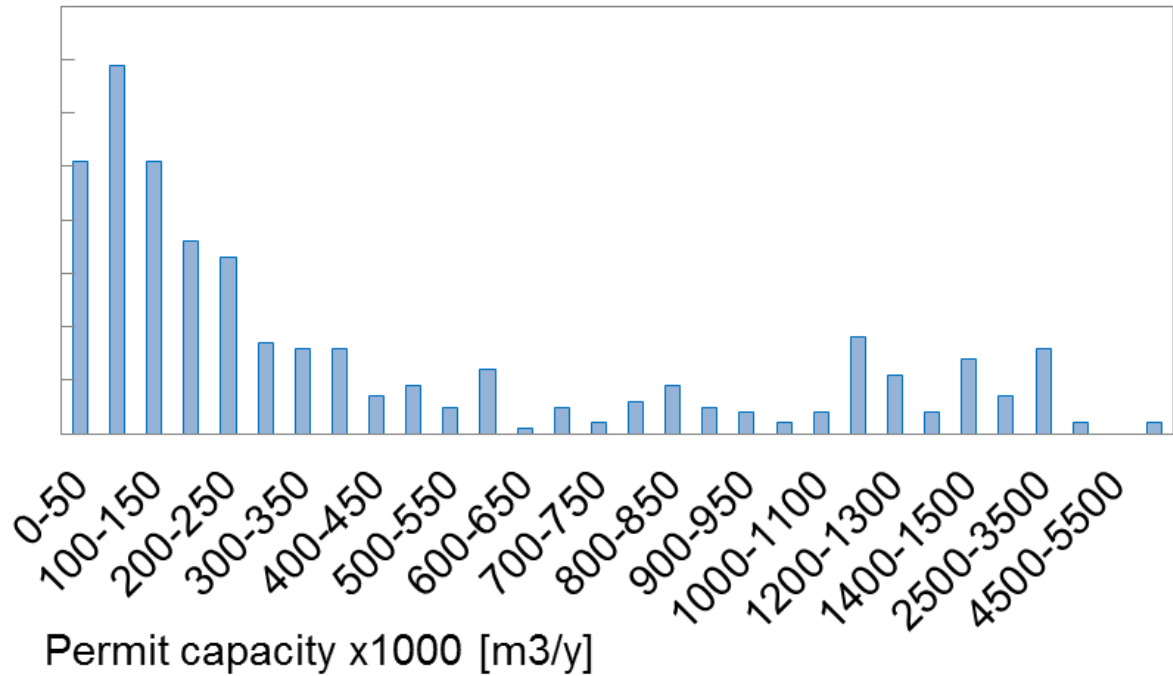
~750,000 m³

HT-ATES @ TUDelft





number of ATES systems [-]



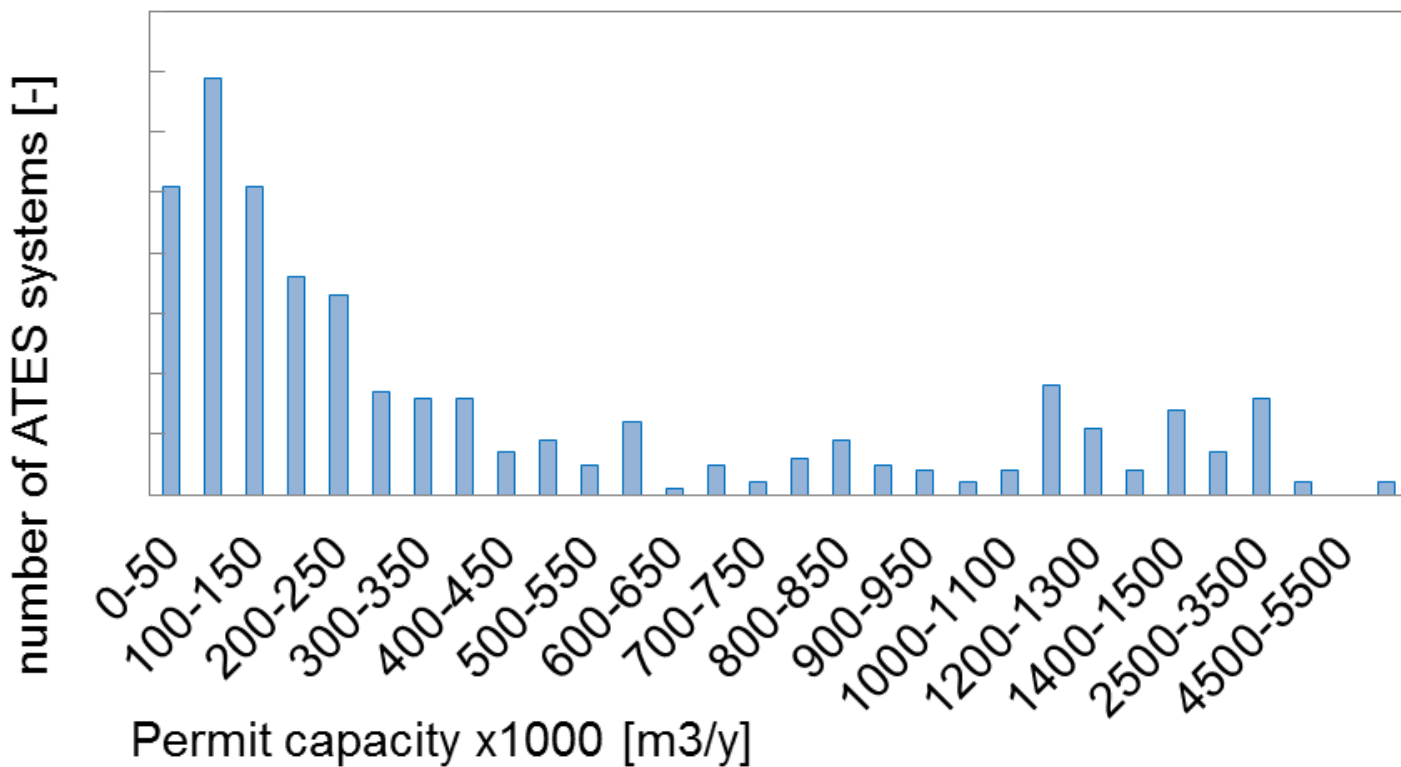
Bloemendal, M. and N. Hartog (2018). "Analysis of the impact of storage conditions on the thermal recovery efficiency of low-temperature ATES systems." *Geothermics* 17(C): 306-319.

20 --- 100 ----- 2000

10TJ ----- 100 TJ ----- 1PJ



Heat storage for district heating of Amsterdam



KWR

TU Delft

Take home message

- Some challenges to tackle, but:
- Aquifers = Time & Space
- HT-ATES is complementary to geothermal systems
- HT-ATES offers back-up/redundancy
- NL = ATES

Opportunities and challenges for large scale HT-ATES systems

DAP symposium 2019-03-12
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