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

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Opportunities and challenges for large scale HT-ATES systems

Martin Bloemendal
2019-03-12

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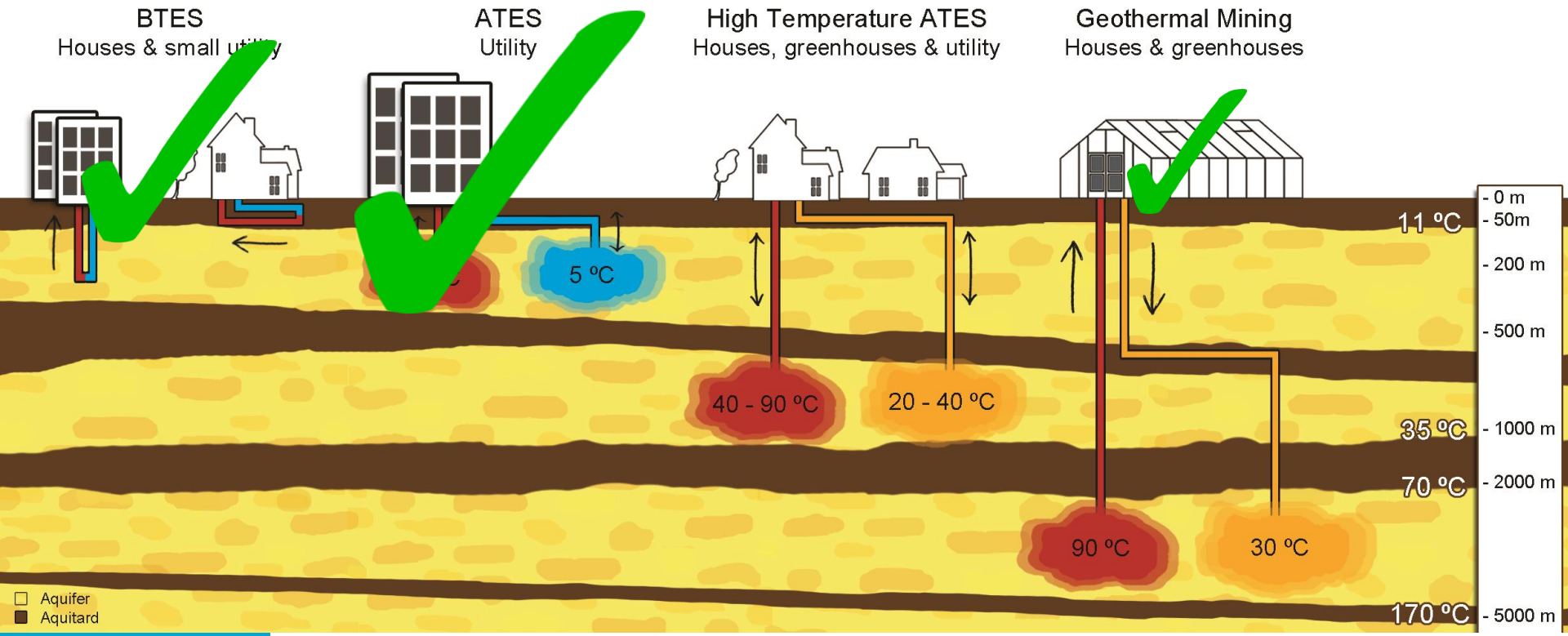
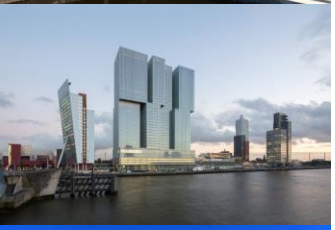
TU Delft

Geothermal Energy in NL



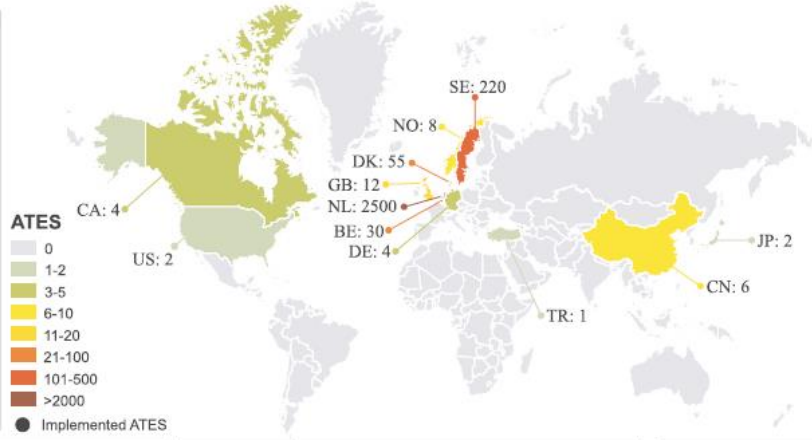



Netherlands &
Belgium


China & Japan

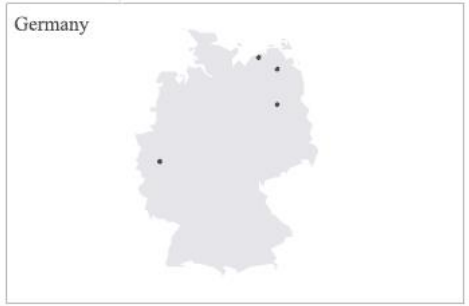

Denmark


Great Britain


ATES
0
1-2
3-5
6-10
11-20
21-100
101-500
>2000
Implemented ATES
CA: 4
US: 2
SE: 220
NO: 8
DK: 55
GB: 12
NL: 2500
BE: 30
DE: 4
JP: 2
CN: 6
TR: 1

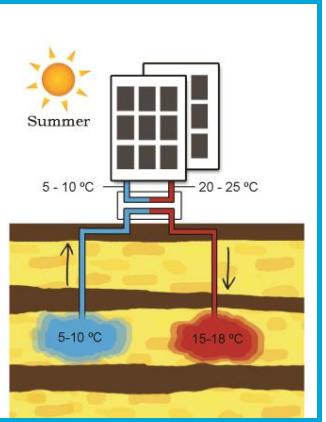

Sweden & Norway


North America

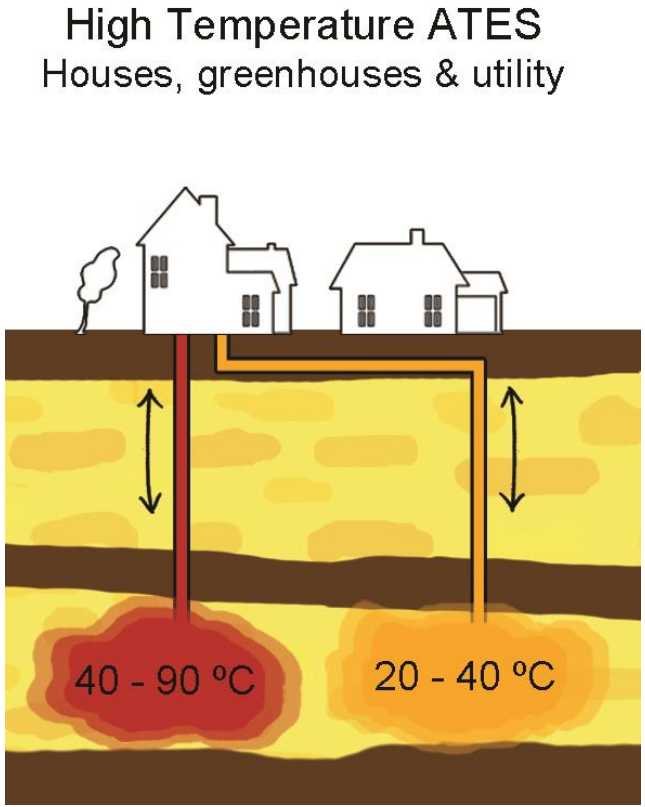

Germany


Turkey

HT-ATES



- >25°C
- Currently permitted as “pilot-projects”



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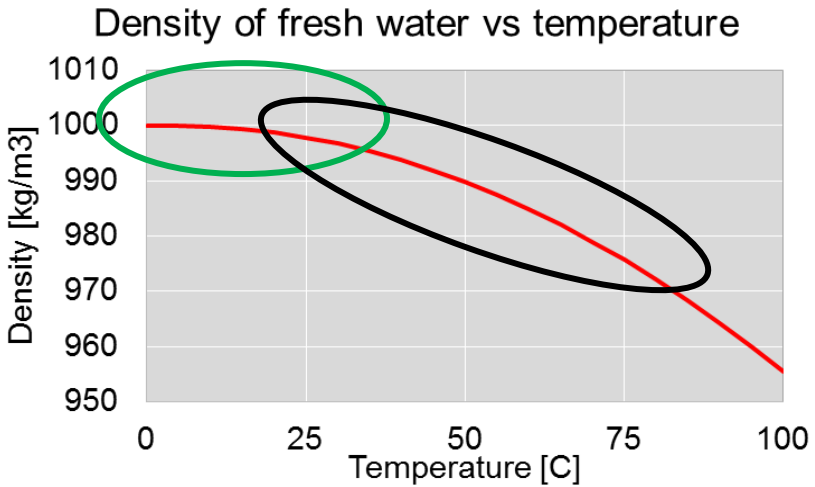
Challenges

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



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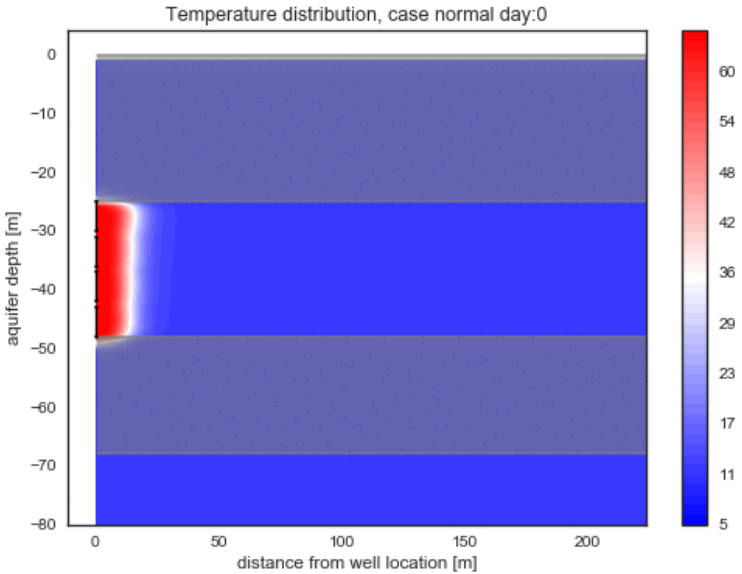
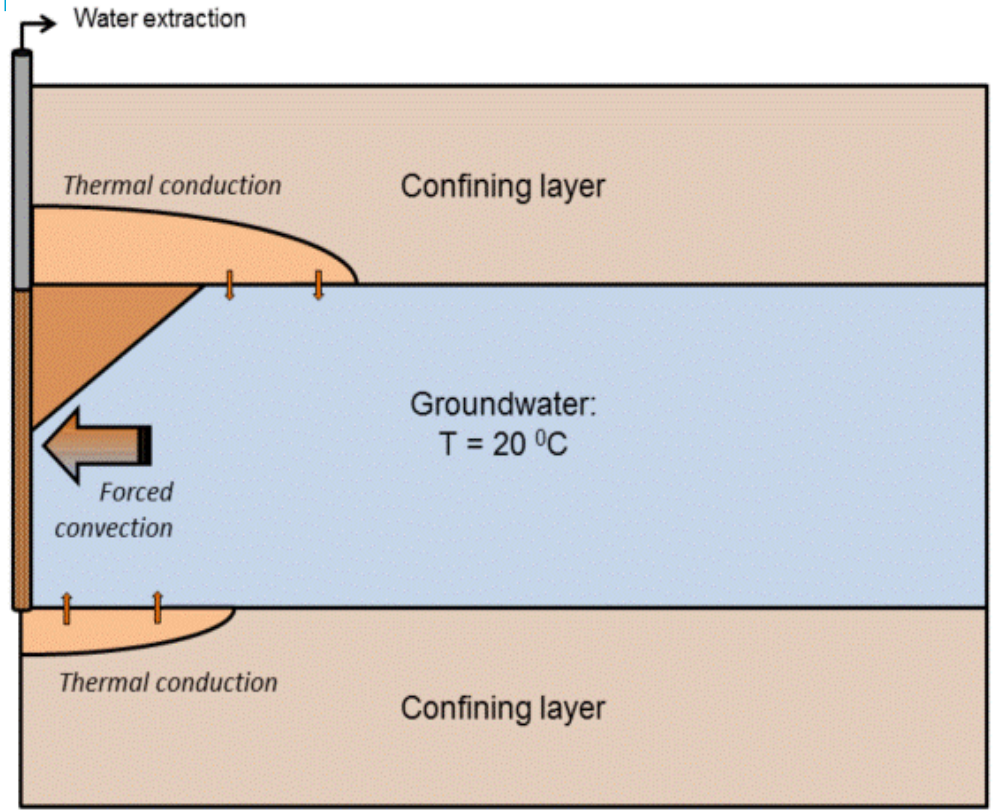
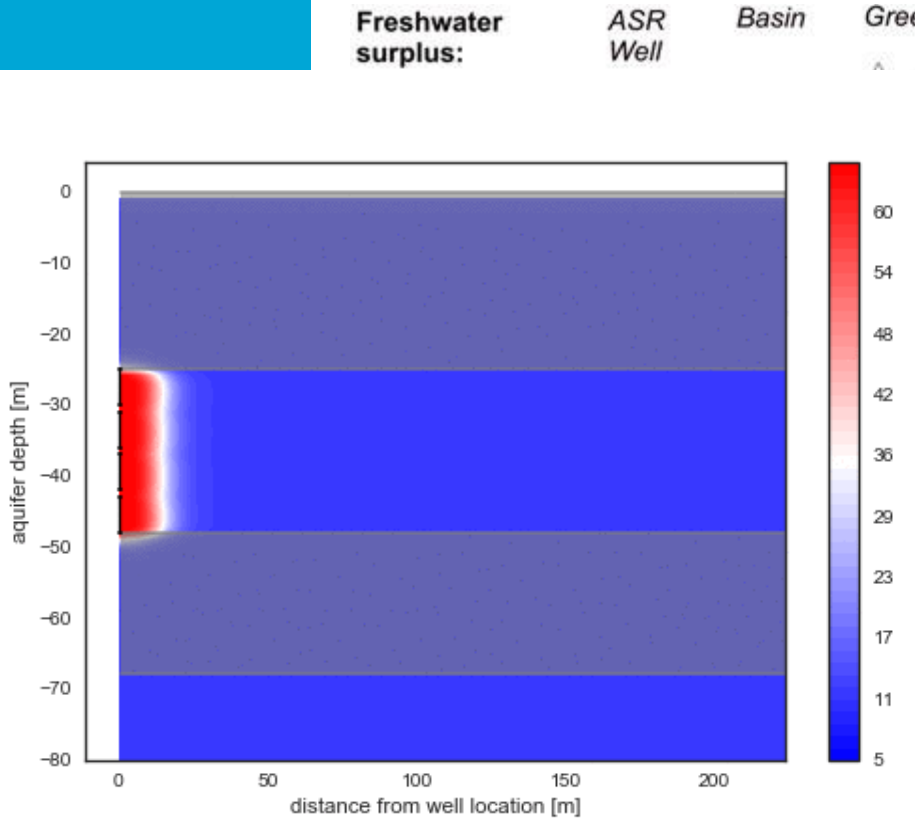
HT-ATES→ Buoyancy

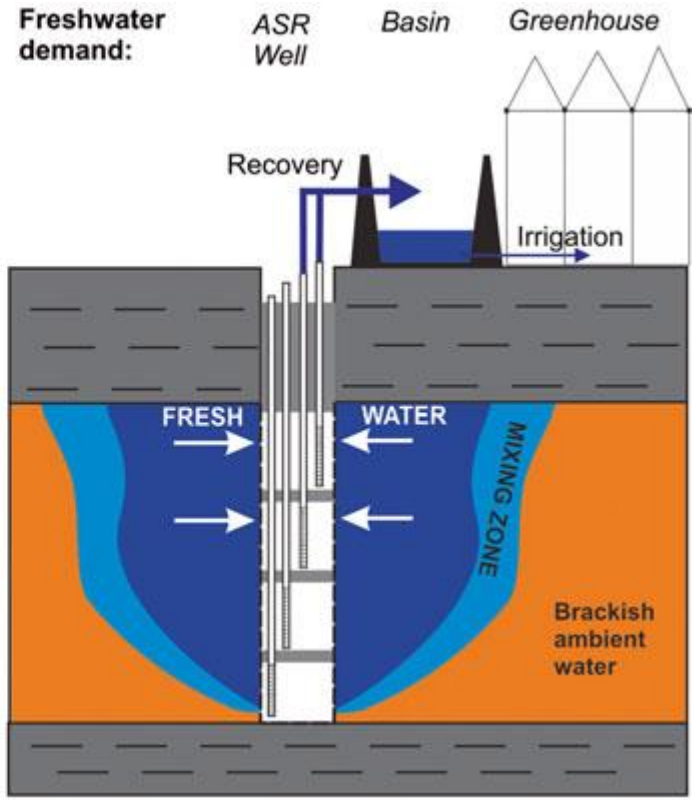




Lopik, J. H. v., N. Hartog and W. J. Zaadnoordijk (2016). "The use of salinity contrast for density difference compensation to improve the thermal recovery efficiency in high-temperature aquifer thermal energy storage systems." Hydrogeology Journal.

Multi partially penetrating wells

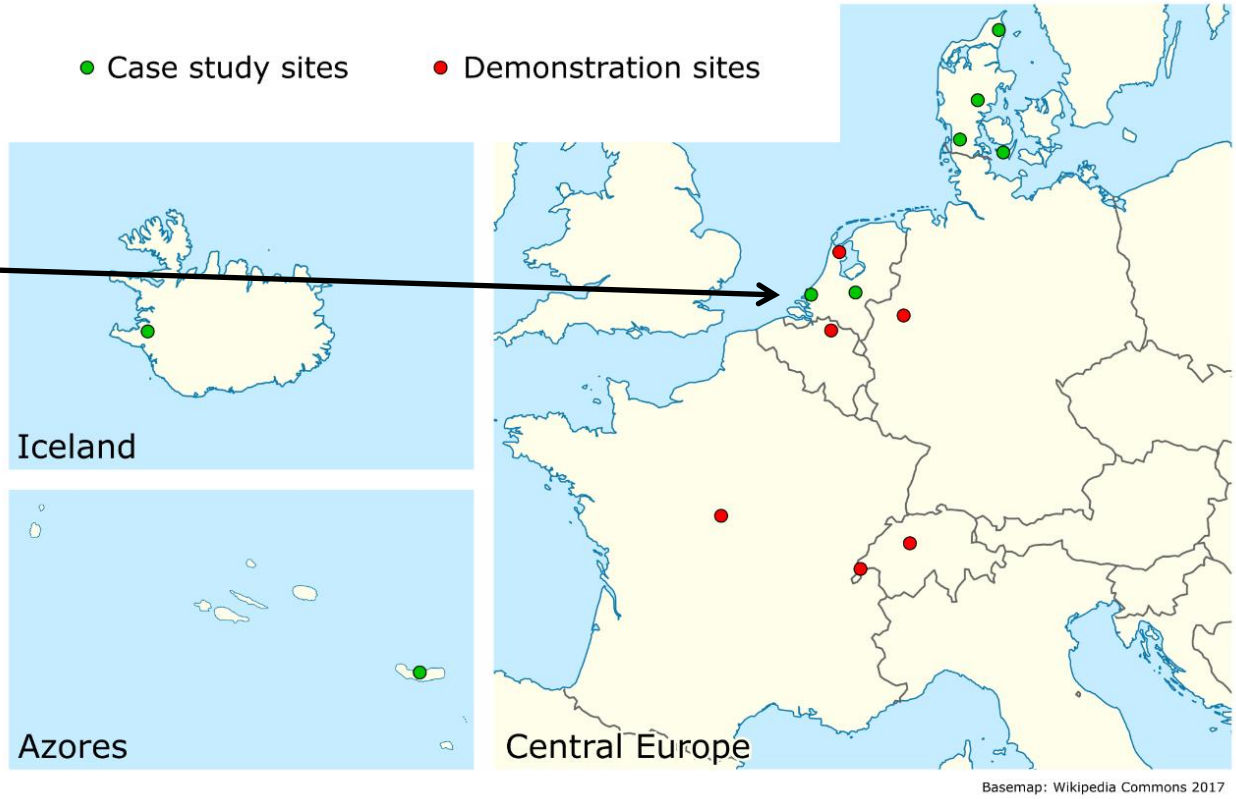




Effects
Efficiency
GW-quality

EGC 19
field-trip

HEATSTORE (geothermica funding)



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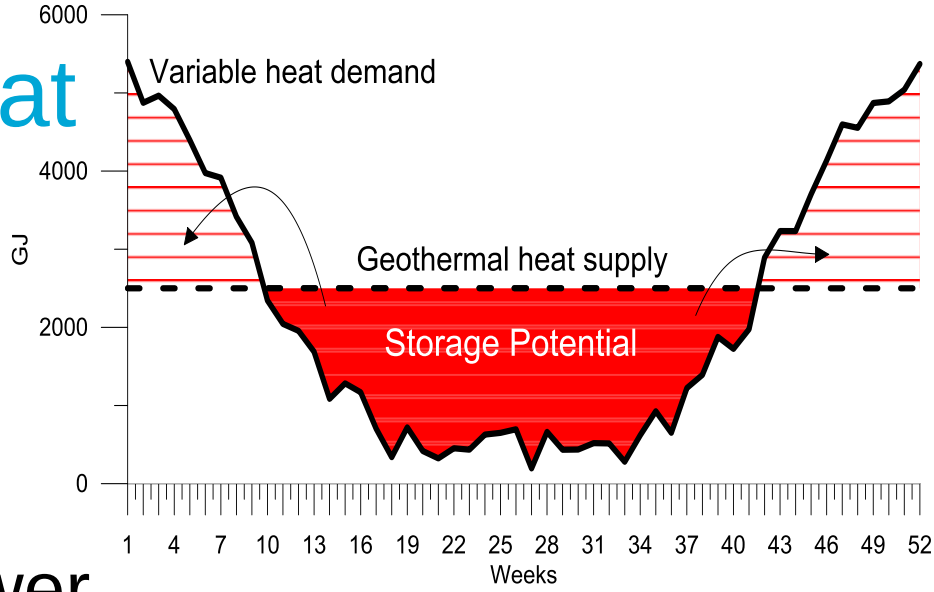
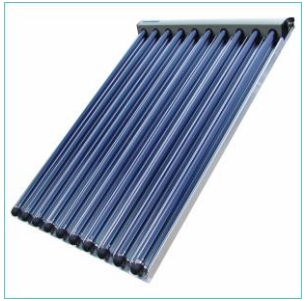
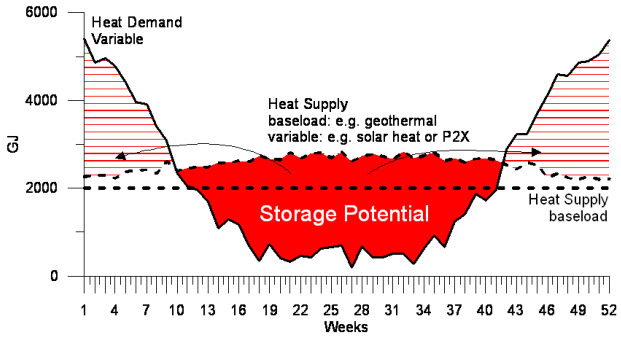
Sources of heat

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







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Demand:
180 TJ/y

Direct from DAP-well :
180TJ/y

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

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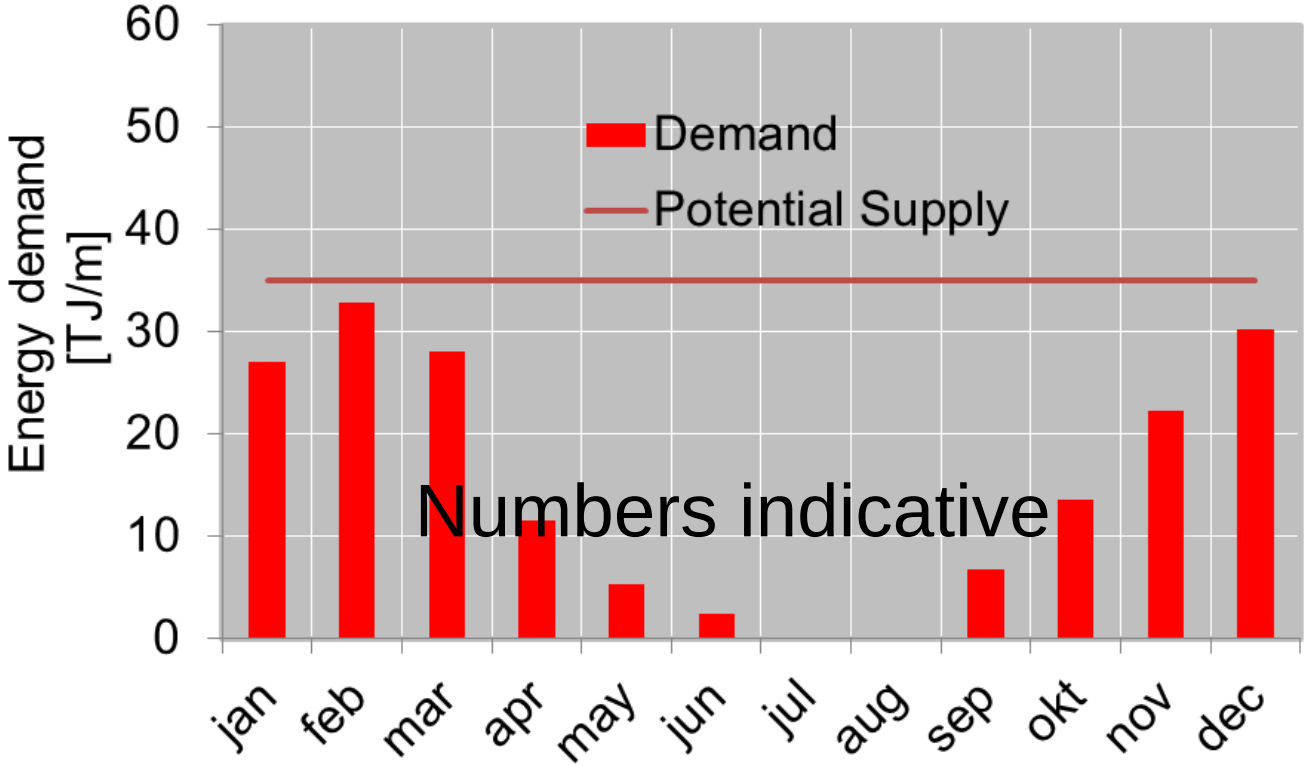
HT-ATES @ TUDelft



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

BACK-UP/ redundancy

Store:
~100TJ

~750,000 m^3

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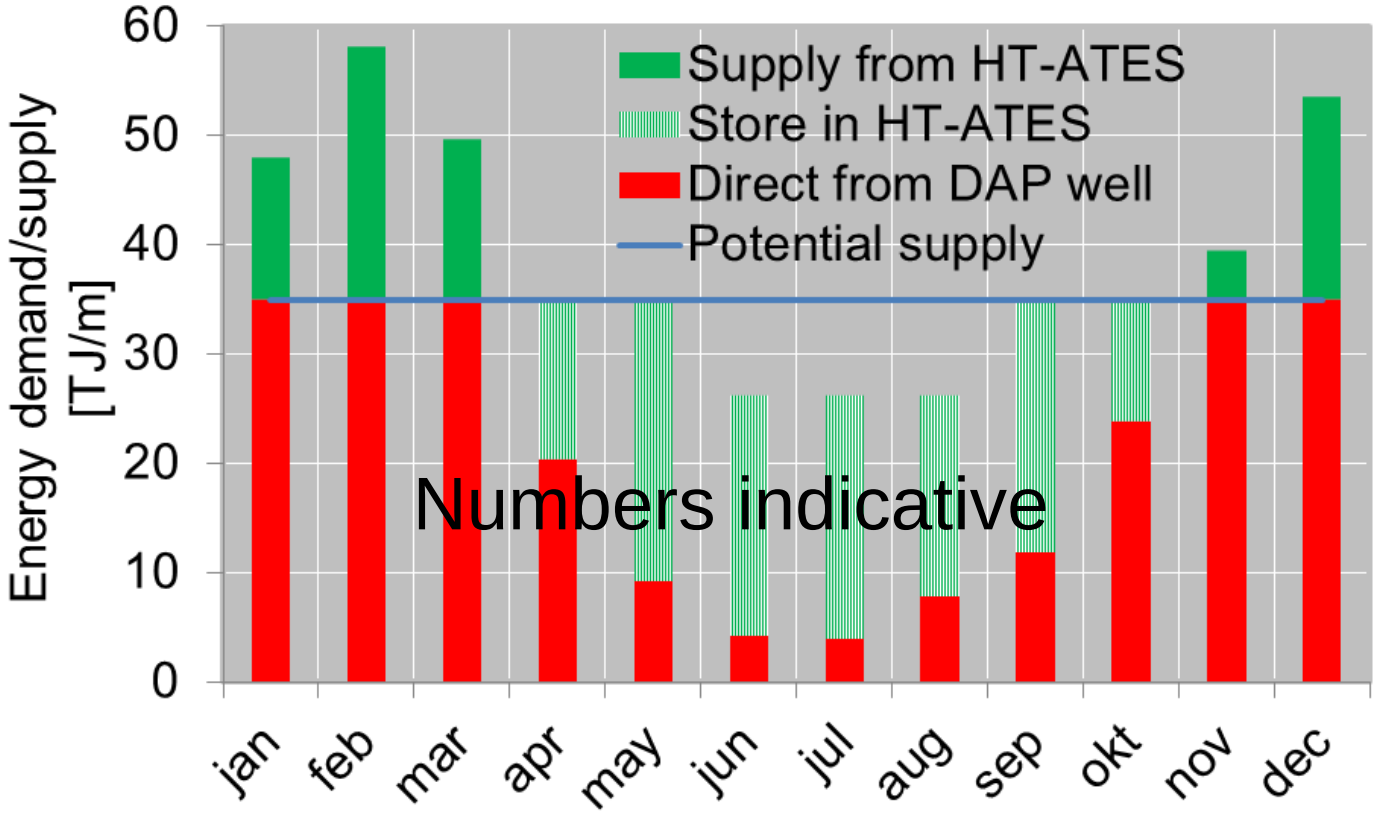
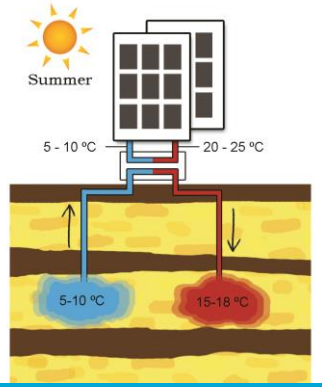
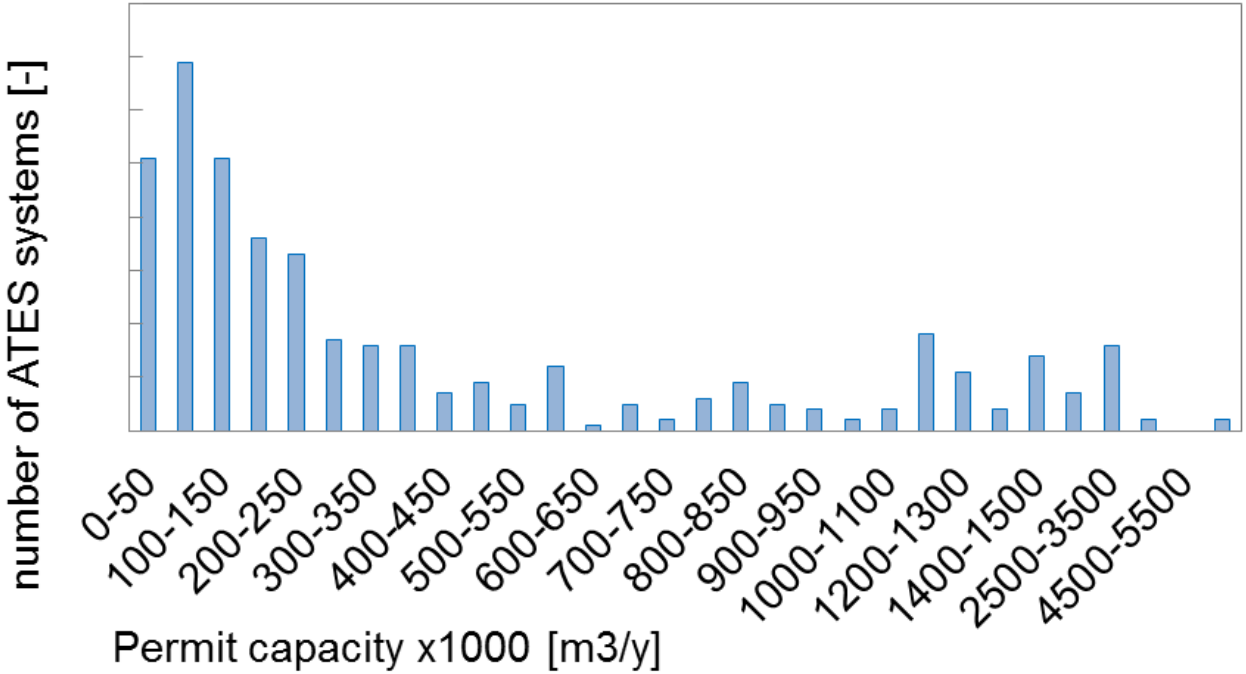
HT-ATES @ TUDelft





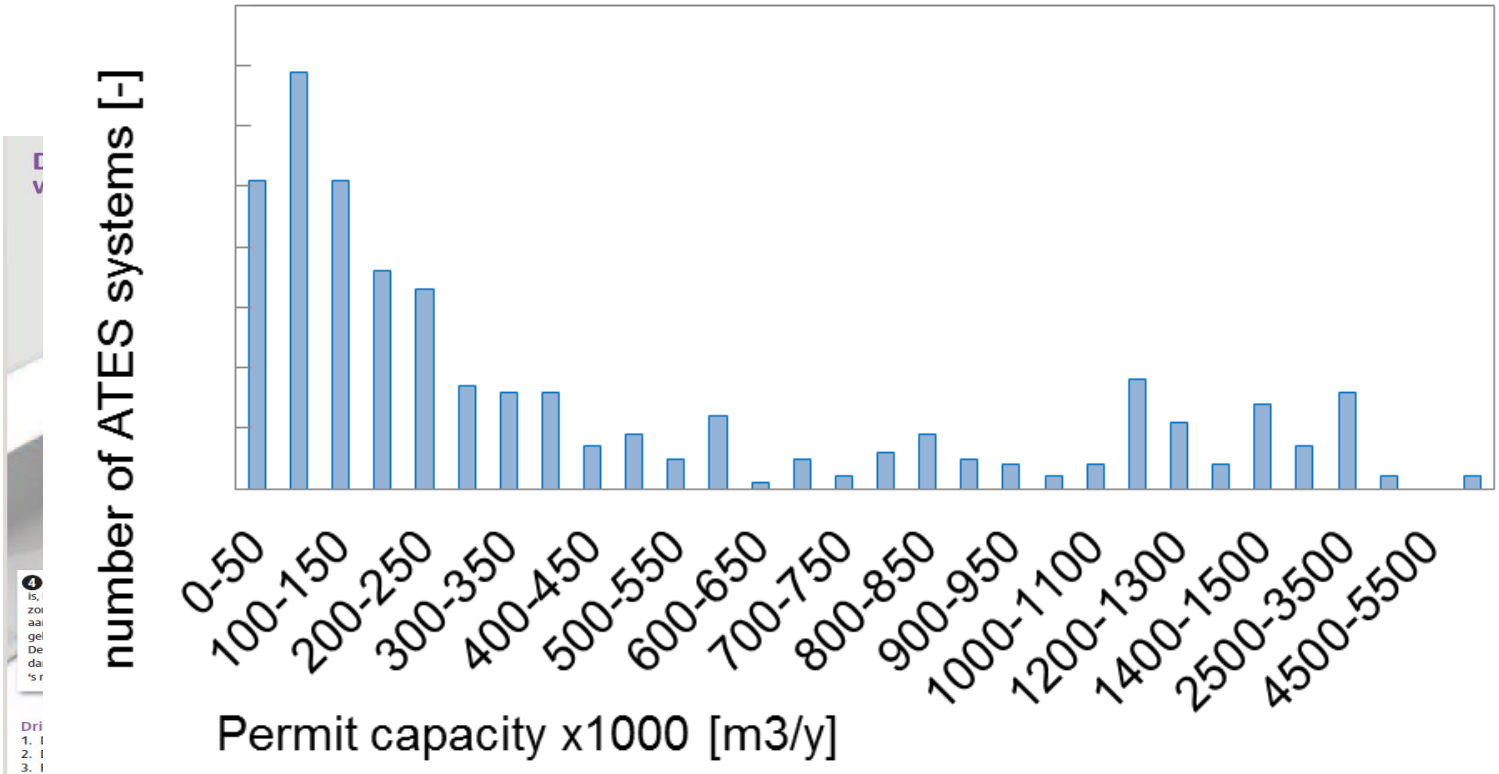


Bloemendal, M. and N. Hartog (2018). "Analysis of the impact of storage conditions on the thermal recovery efficiency of low-temperature ATES systems." Geothermics 17(C): 306-319.

20 --- 100 ---------- 2000

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

Heat storage for district heating of Amsterdam



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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

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Opportunities and challenges for large scale HT-ATES systems

DAP symposium 2019-03-12

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