(HT-)ATES system of Koppert-Cress

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The ATES system of KC
ATES

Summer

5 - 10 °C  
20 - 25 °C

Winter

20 - 25 °C  
40 - 50 °C

5-10 °C  15-18 °C

5-10 °C  15-18 °C

KWR

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Koppert-Cress: HT-ATES pilot

- >25°C
- Permitted as “pilot-project”
- max 40°C
- Goal: Performance & monitor impact
The transition to HT-ATES

- **Heating** demand > **Cooling** demand
  - System not in balance
- Add extra (HT) heat
- Transition: storage temperature increases after 2015
Extra heat and higher temperature

Mostly passive heat sources
Increasing $T_{\text{in}} \& \Delta T$
Improved performance

- 10% lower operational costs
- 30-70% less GHG
The monitoring system
Impact

- Limited average T-increase
- No microbiological / chemical effects linked to temperature observed
- Mixing dominates in WQ effects
Conclusions

• Imbalanced system can be efficiently compensated with external heat
• Thermal impact is small
• Water quality changes not linked to temperature
• Energy efficiency is greatly improved
(HT-)ATES system of Koppert-Cress

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Future developments for Koppert Cress

The transition is not done yet…

• more heat will become available
• More heat in warm wells → Long-term heating of subsurface around warm wells
• Continued monitoring
The ATES system of KC

The diagram illustrates the soil types and their respective depths. The vertical axes represent depth in meters (m), with levels at -25, -50, -75, -100, -125, and -150. The horizontal axis represents the X-coordinate in meters (m), ranging from 71500 to 75000.

Soil types are categorized into Aquifer and Aquitard, with Aquifer being represented in yellow and Aquitard in gray. Shallow screen and Deep screen are indicated on the diagram.
Increasing $T_{in}$ & $\Delta T$
ATES system not in balance
ATES system not in balance

End of winter

End of summer
DTS location

Laagtype
- Aquifer
- Aquitard

Distance from well (m)
- 2.5
- 8.5
- 13
- 20

Diepte (m)
- 0
- 25
- 50
- 75
- 100
- 125
- 150
- 175

Shallow Screen
Deep screen
DTS monitoring
Warm well 1

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DTS monitoring

Summer 2020
Thermal impact: horizontal

Long-term horizontal impact is small
Thermal impact: vertical

Reference: Steady state conduction through clay layer.
Thermal impact: vertical

Long-term vertical impact is small
Thermal impact: vertical

DTS 2.5m, shallow aquifer

Depth (m)

Temp. Increase (°C)

aquifer

aquitards
What else did we investigate?

• Performance of heating/cooling system
  – 10% lower operational costs
  – 30-70% less GHG

• Groundwater monitoring
  – Chemical analysis
  – Micro-biological analysis

https://library.kwrwater.nl/publication/61755396/
From temperature data to thermal impact

- Horizontal impact
- Vertical impact

Well screen