Drivers for Widespread Adoption of ATES Systems

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Paris - 2023-05-24
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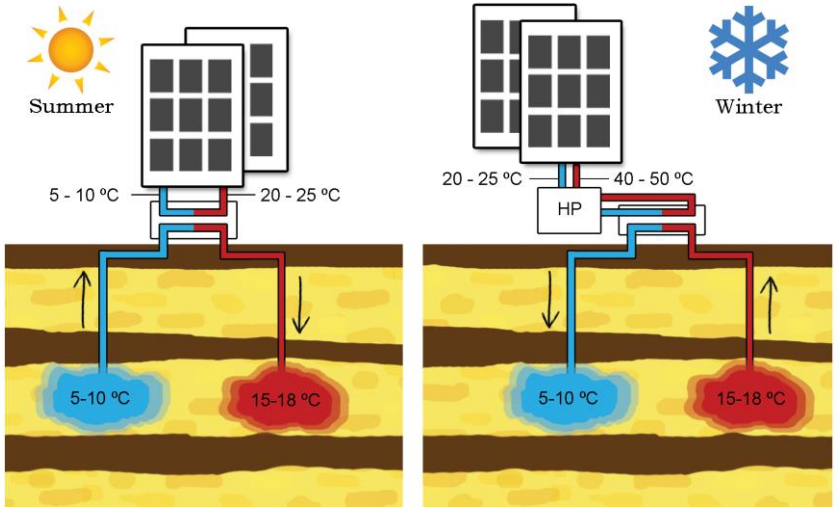
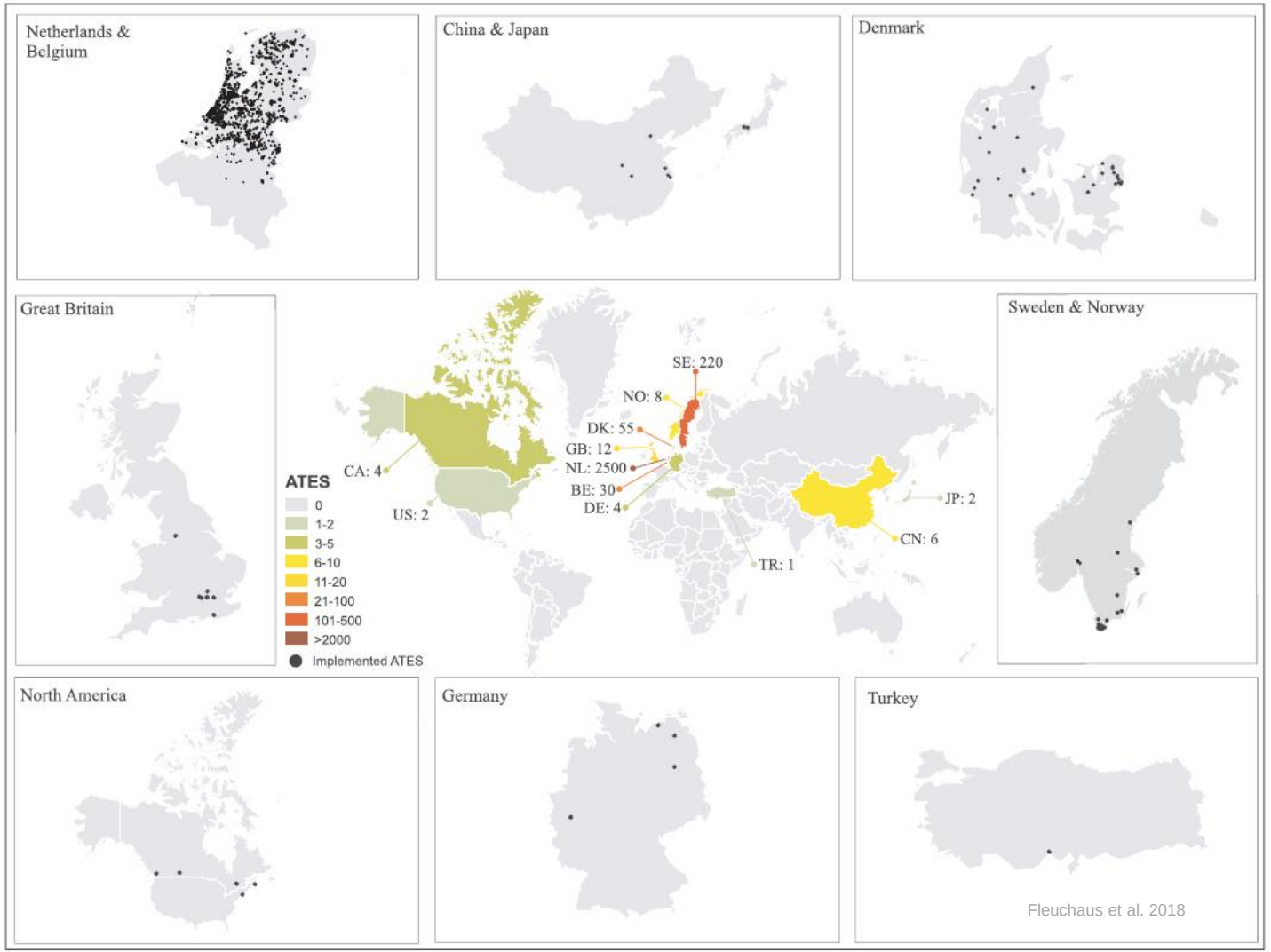
2nd European Underground Energy Storage Workshop





Fleuchaus et al. 2018

4 main drivers

1. Building energy performance regulation
2. Planning and permitting of ATES wells
3. Well standards/quality
4. ATES surface plant standardisation

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1. **Building energy performance regulation**
2. Planning and permitting of ATES wells
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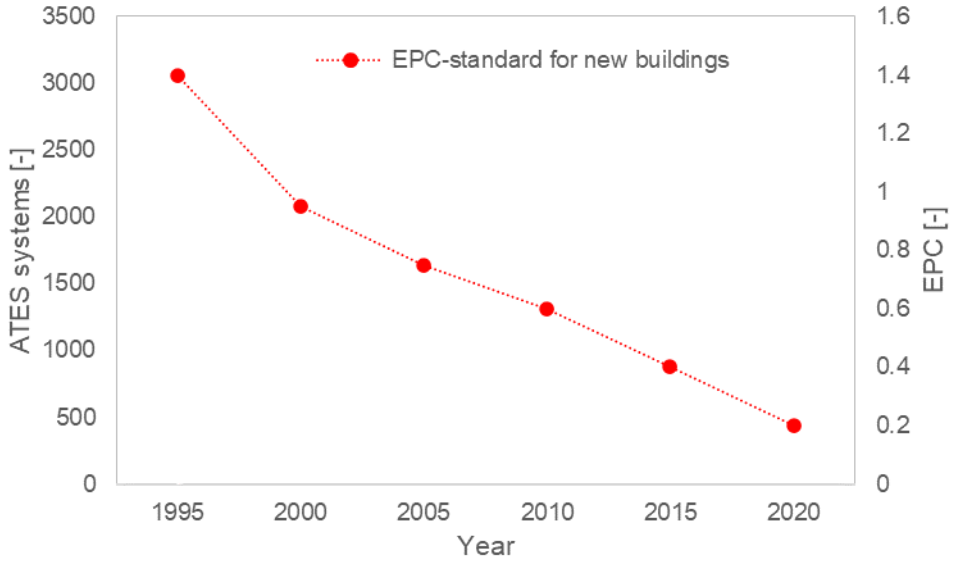
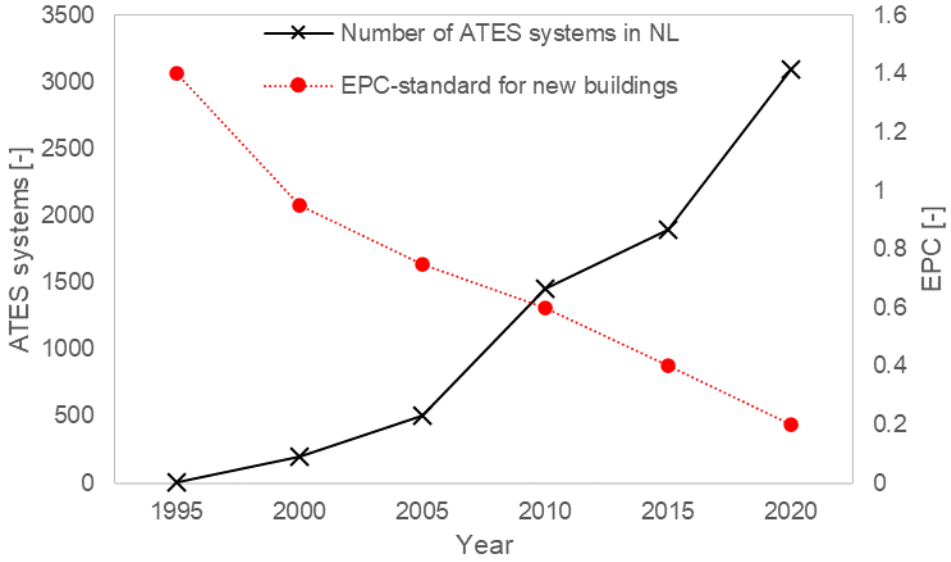
Energy efficiency standard

- New buildings



ATES in NL

- Resulted in strong adoption



Also existing buildings in future?

ATES in NL

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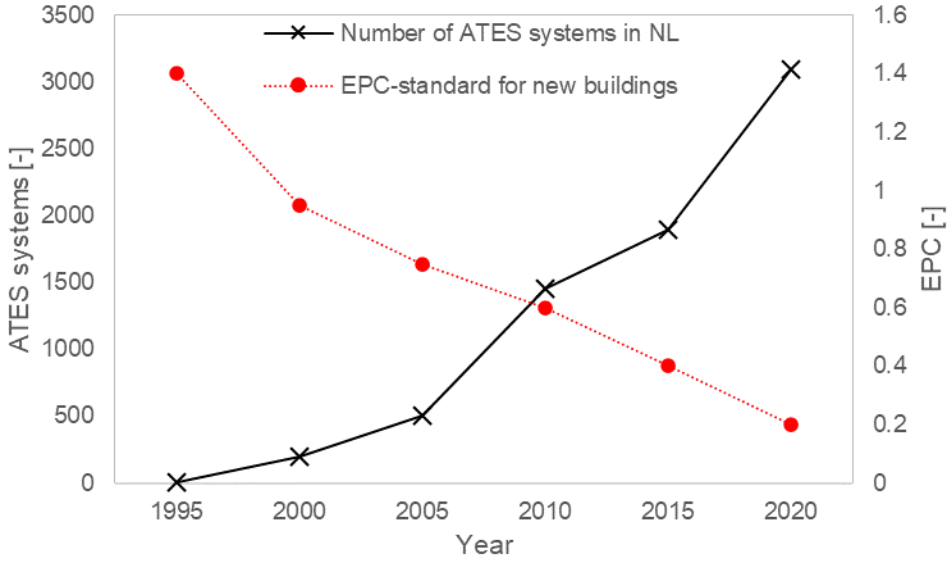

Despite CAPEX being >2x conventional

ATES in NL

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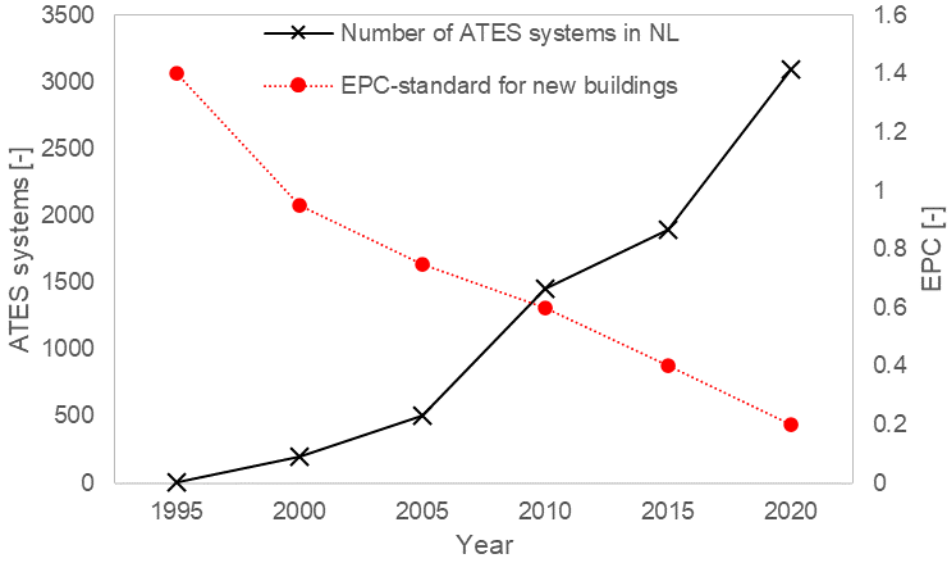


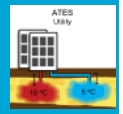
Pitfall of EPC: ATES is applied, but owners don't care about performance

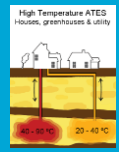
Despite CAPEX being >2x conventional

4 main drivers

1. Building energy performance regulation
2. **Planning and permitting of ATES wells**
3. Well standards/quality
4. ATES surface plant standardisation

Legislation situation <2014

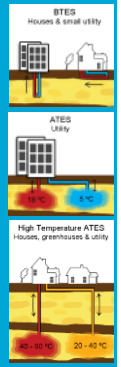




- BHE: None
- ATES: 6 months permit procedure; different rules/ province
- HT-ATES: GS decision

Legislation situation >2014

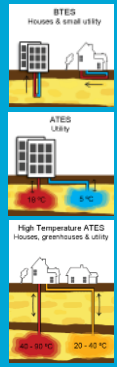
After extensive research to impact of ATES and BHE



- Reporting obligation, permit >70kW
- 6 wk permit procedure;
  uniform rules across NL
- GS decision; Pilots stimulated

- First come – first serve
- Large well distances

Legislation situation >2014



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- In busy areas: possibility to plan
- Certification requirement
- Reporting & enforcement of performance

Certification Scheme

6 scopes:

	Design	Build	Operate
Wells/boreholes			
Building Climate installation			

Certification

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	Design	Build	Operate
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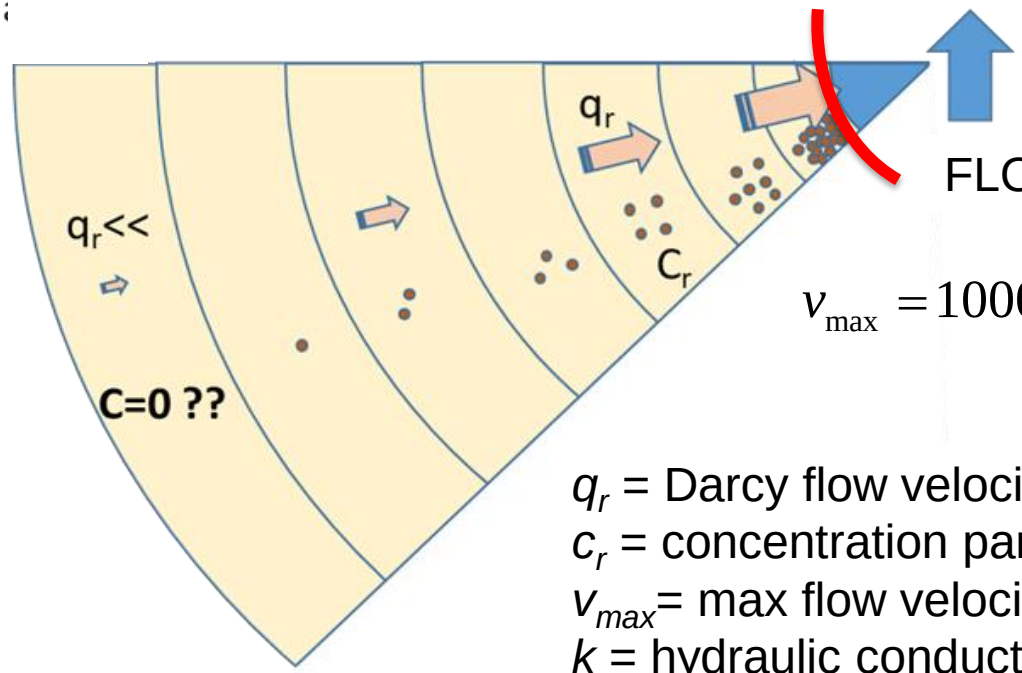
Wells


61 62 63 64 65 66 67 68 69 70 71 72 73 74 75
76 77 78 79 80 81 82 83 84 85 86 87 88 89 90

Mechanical clogging

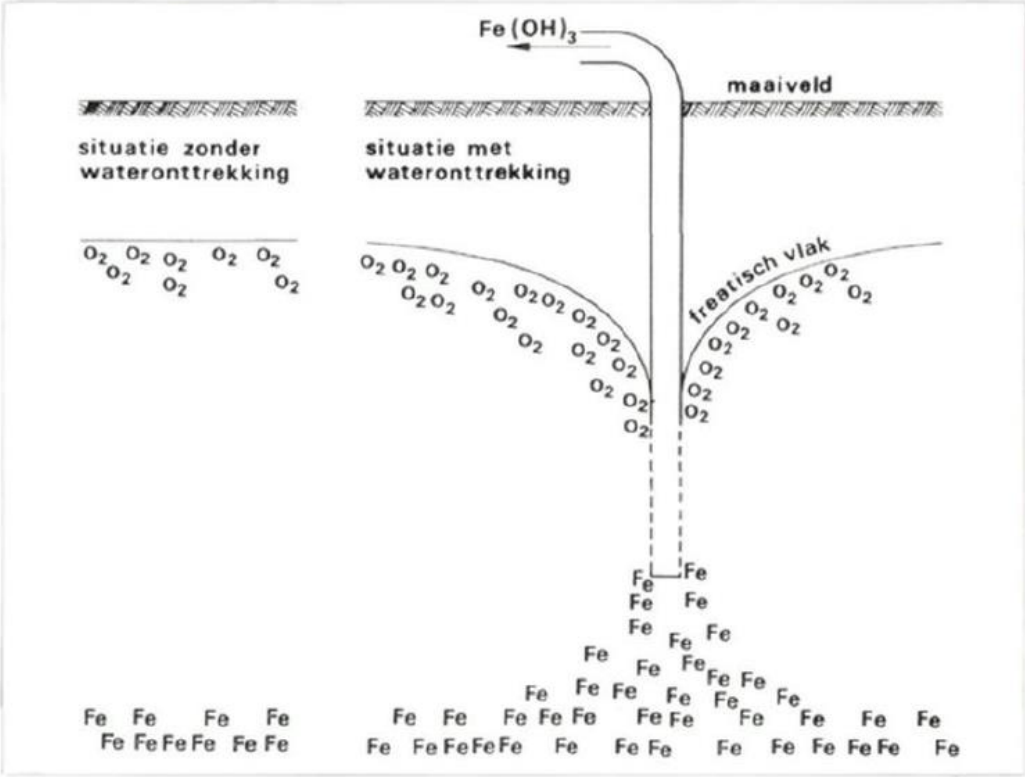
- Radial flow → particle cumulate near well

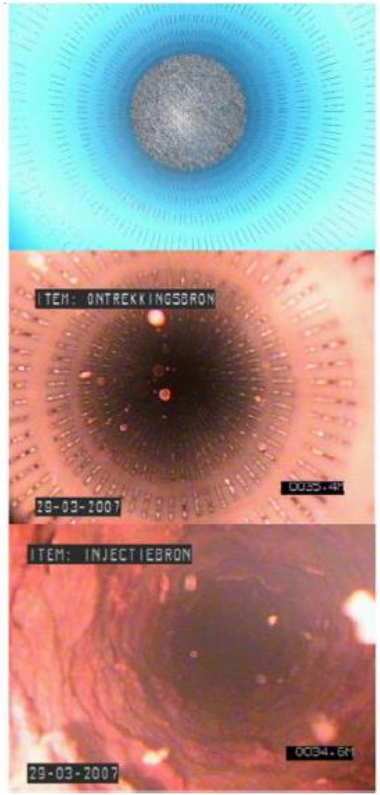


$$v_{max} = 1000 \cdot \left(\frac{k}{150}\right)^{0.6} \cdot \sqrt{\frac{v_v}{2 \cdot MFI \cdot u_{eq}}}$$

q_r = Darcy flow velocity at distance r
c_r = concentration particles
v_{max}= max flow velocity at borehole wall
k = hydraulic conductivity

Chemical clogging





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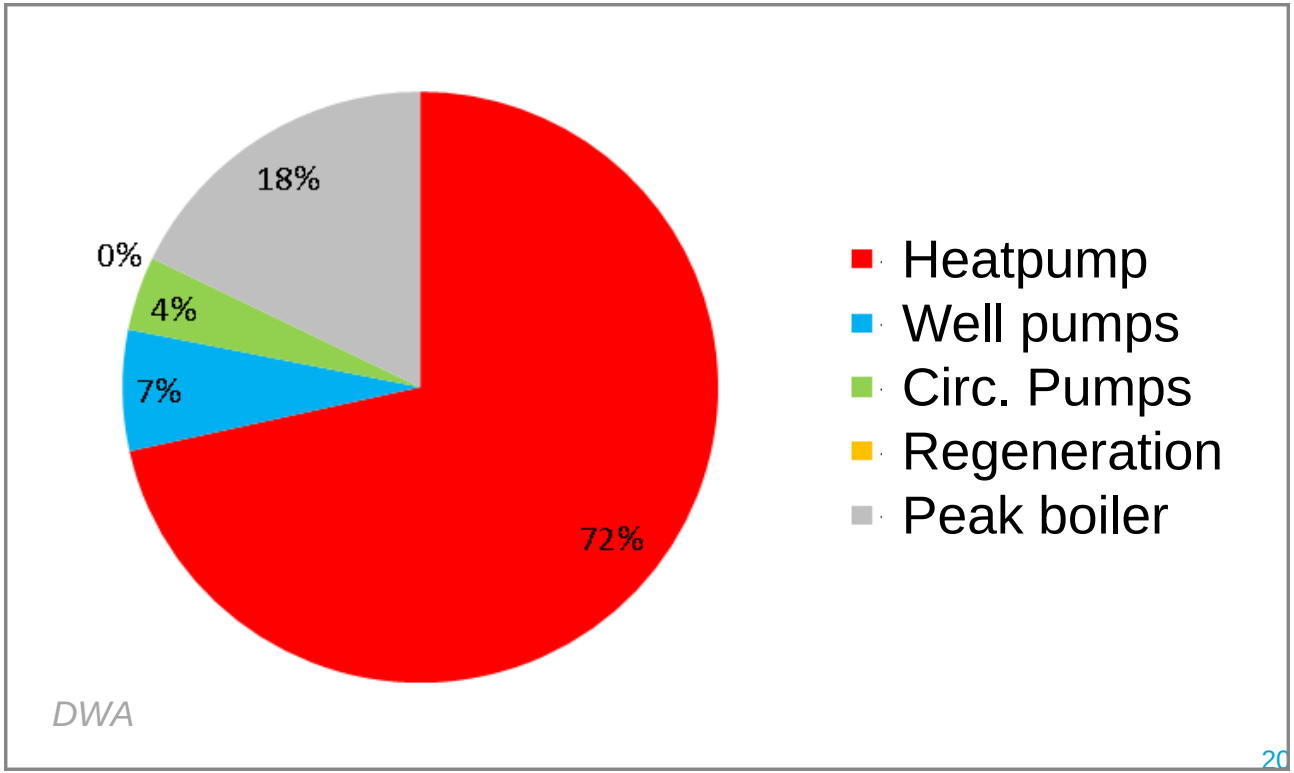
4. **ATES surface plant standardisation**

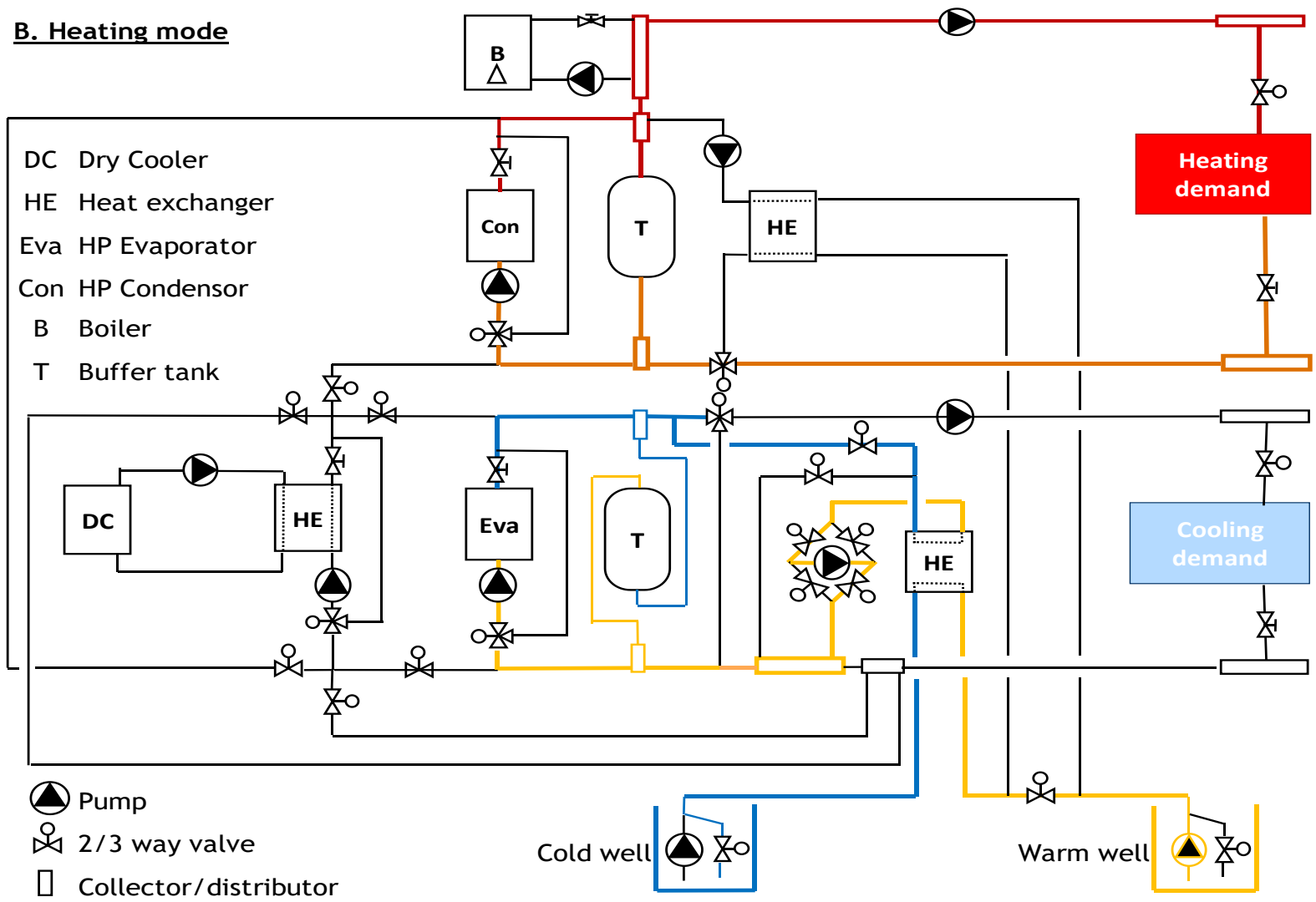
Importance of building facilities

Relative contribution of components to total energy use of ATES system



GEOTHERMAL DHC
Towards Decarbonized Heating and Cooling!

B. Heating mode



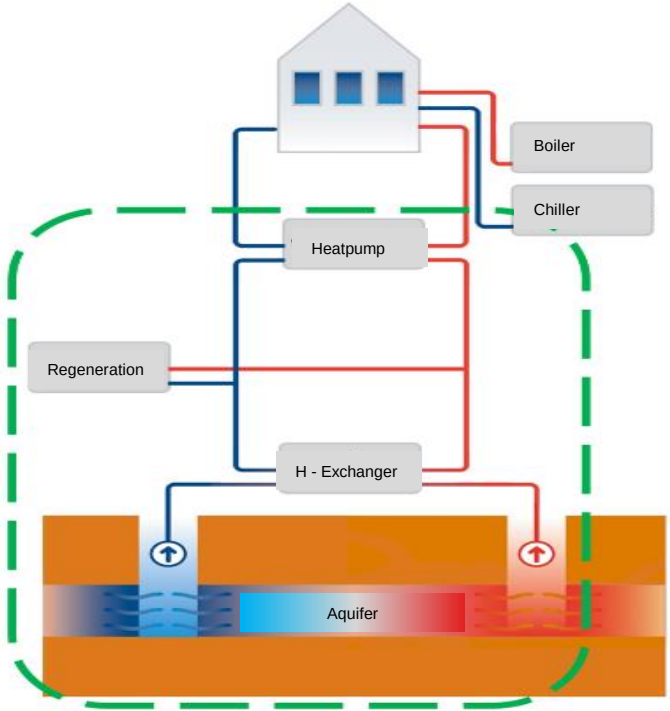
TU Delft

Enforce energy performance

- Seasonal Performance Factor

$$SPF = \frac{\text{Energy delivered by ATES}}{\text{Primary energy use}}$$

KISS



Take home:

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   → High adoption rates

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   → Access to technology
   → GHG emissions go down

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2. Planning and permitting of ATES wells
   → Access to technology
   → GHG emissions go down
3. Well standards/quality
   → Quality standard for ATES is high
4. ATES surface plant standardisation
   → Optimal integration of building - subsurface

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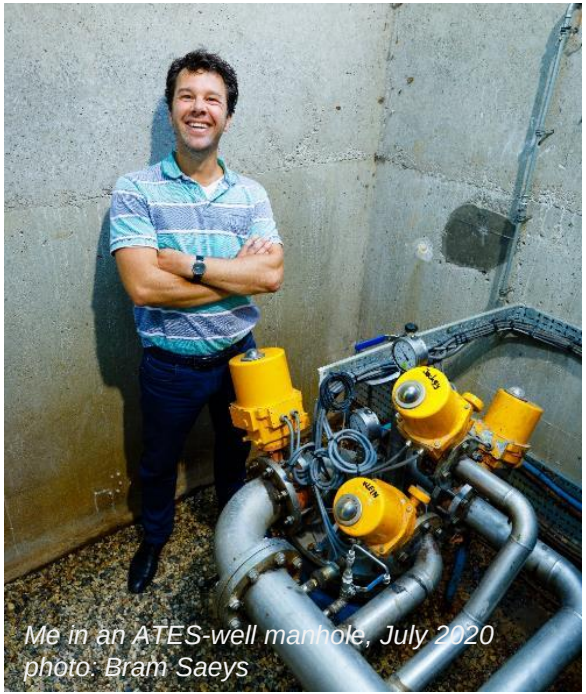

Me in an ATES-well manhole, July 2020
photo: Bram Saeys