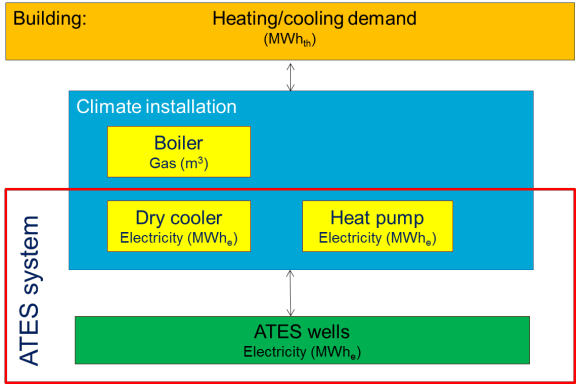
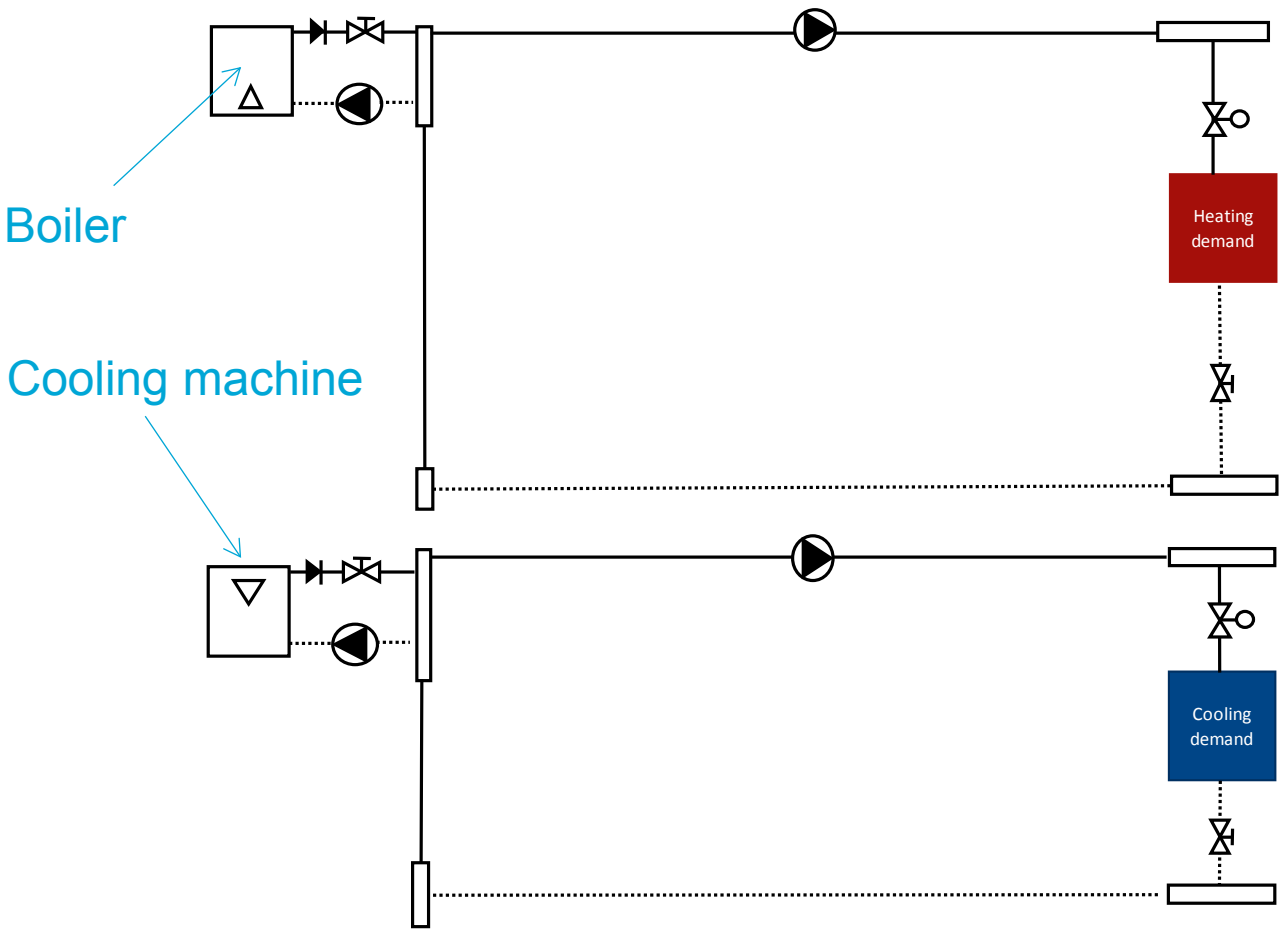
Curriculum on shallow geothermal for professionals in NL



dr. Martin Bloemendal,

Der Geothermiekongress, Munich, 2019-11-19

Conventional vs..



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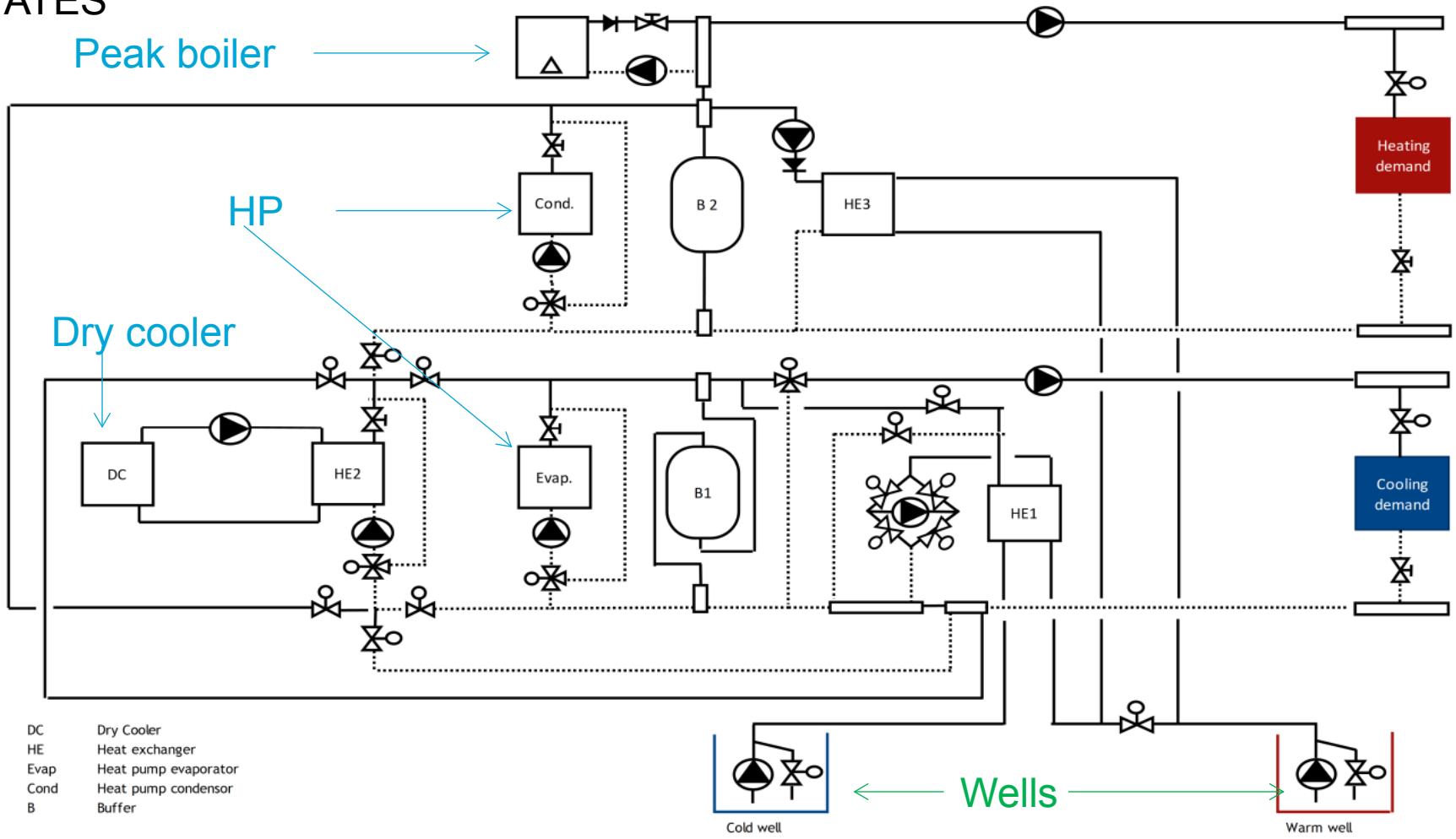
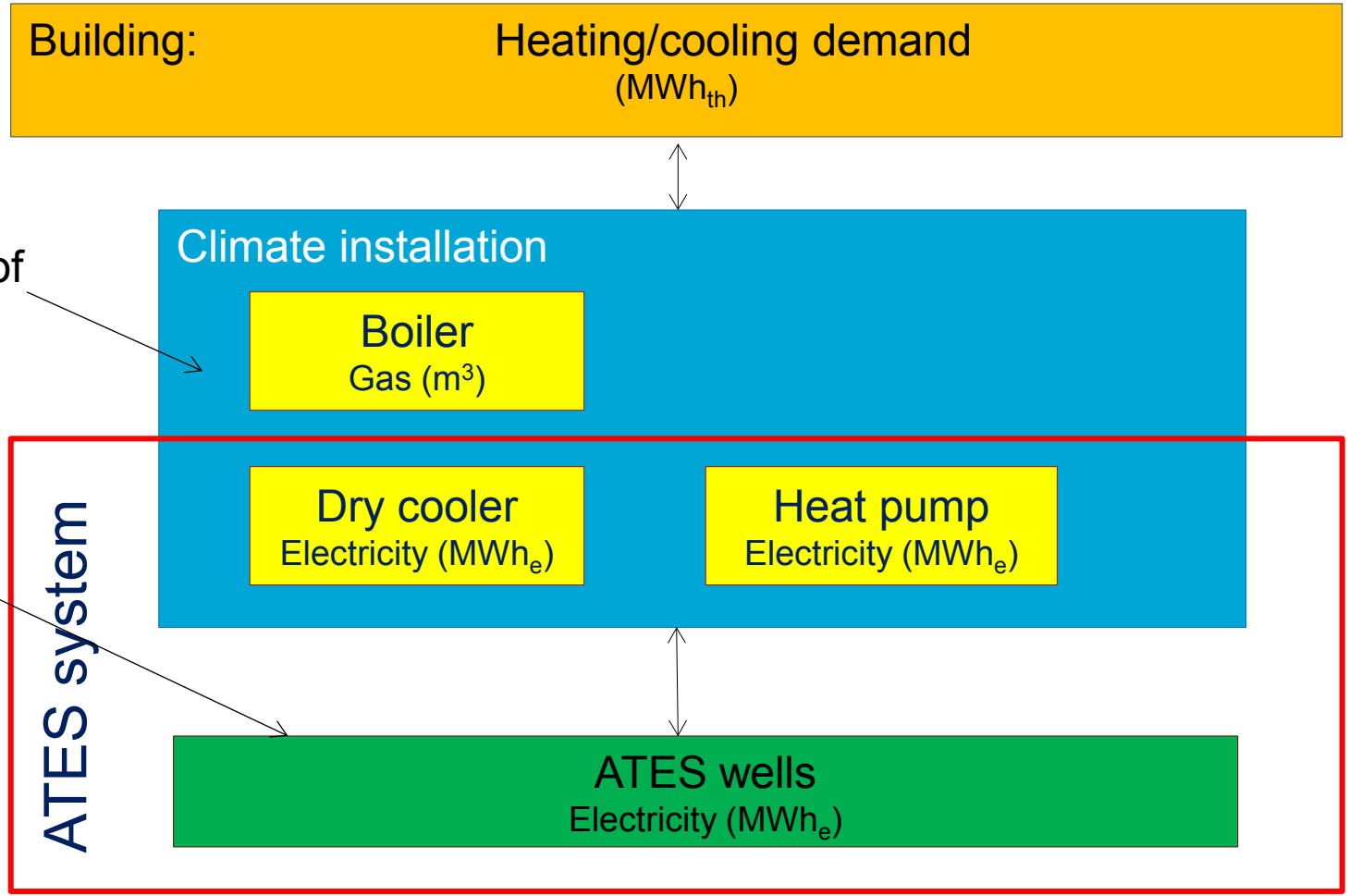
.. ATES


Peak boiler
HP
Dry cooler
Cond.
B 2
HE3
Heating demand
DC
HE2
Evap.
B1
HE1
Cooling demand
Wells
Cold well
Warm well
DC Dry Cooler
HE Heat exchanger
Evap Heat pump evaporator
Cond Heat pump condensor
B Buffer

Minimize energy use of components

Optimize recovery efficiency



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Legislation situation: certification

- Design, Build, Operate
- Drilling& completion, Climate installations

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Co

Challenges

- Inter disciplinary
- High level of detail
- For ATES standardisation is difficult
- Control/operation is key

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Base course

Basic understanding of entire system

- Thermo dynamics
- Building energy demand
- Design concepts
- Geohydrology & wells / boreholes
- Mechanical engineering
- Operation and control
- Policy and permitting

3 full days

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Base course			
Climate installation 3 days	ATES 2 days	BHE 2 days	Exploitation & operation 2 days
Development			
Control software			
ATES & BHE for governments			

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University education

- Curricula are slowly changing
- Courses at:
  - Mechanical engineering
  - Civil engineering
  - Applied earth sciences
  - Sustainable energy technology
  - Several minors

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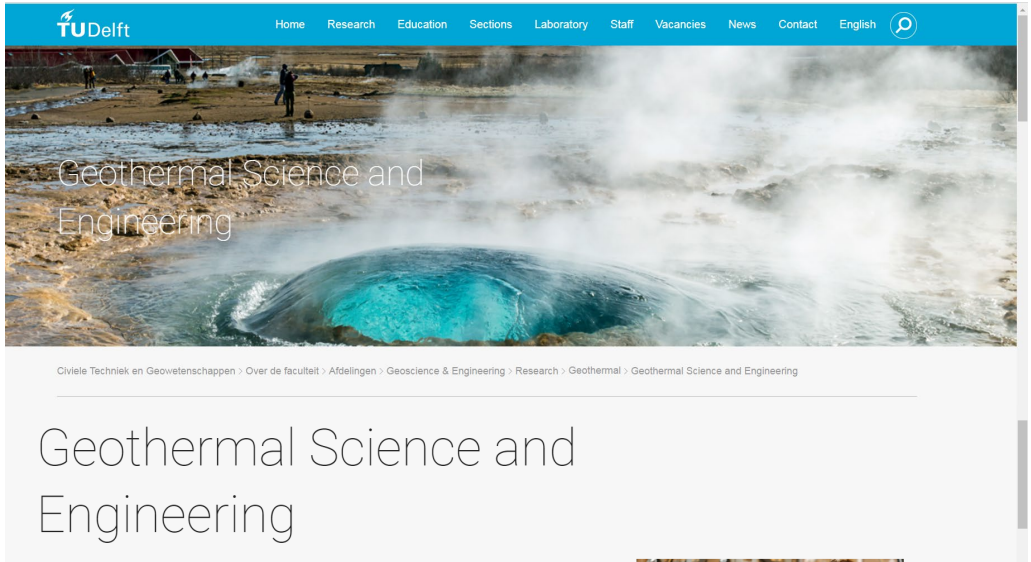
Geothermal research group

Research and education for impact

Shallow and deep technologies



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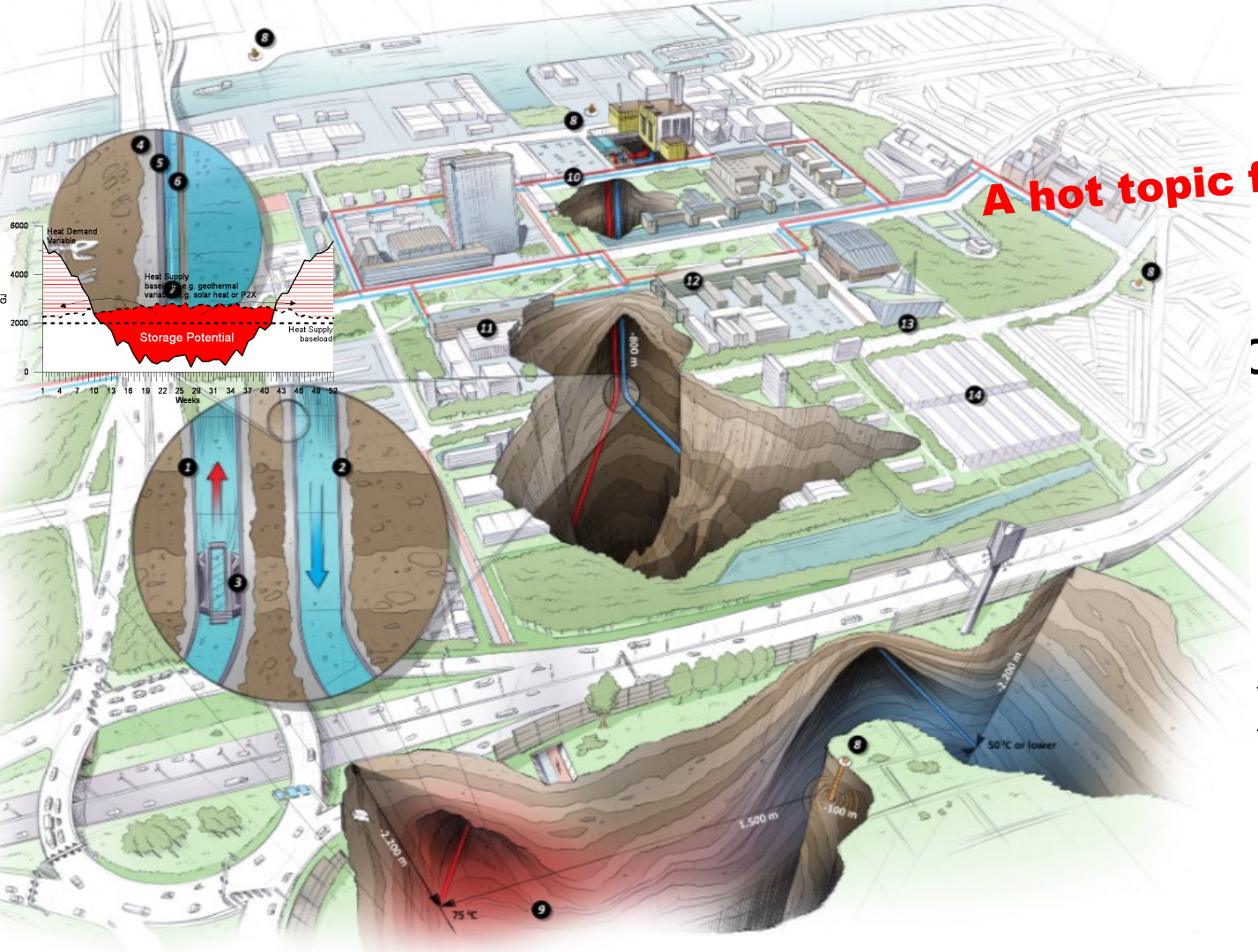

A hot topic for deep research

ducation

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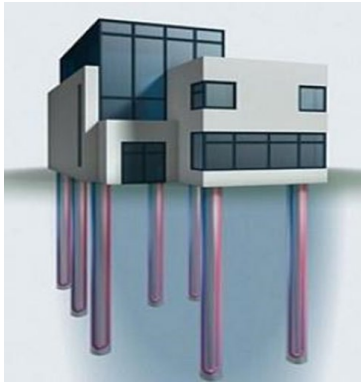

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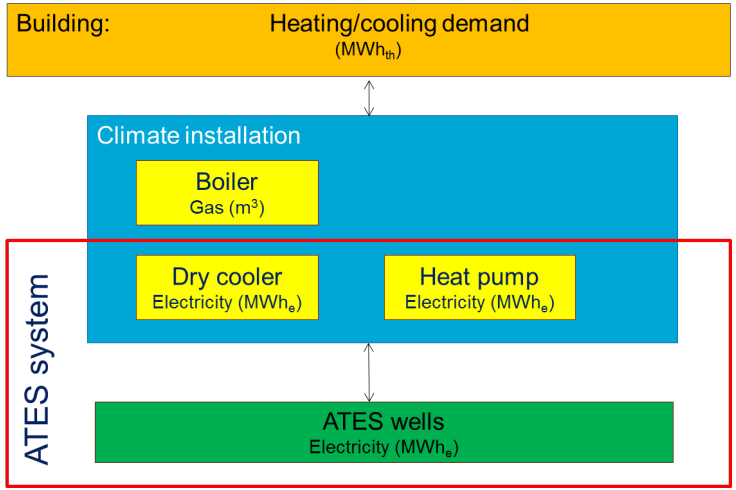

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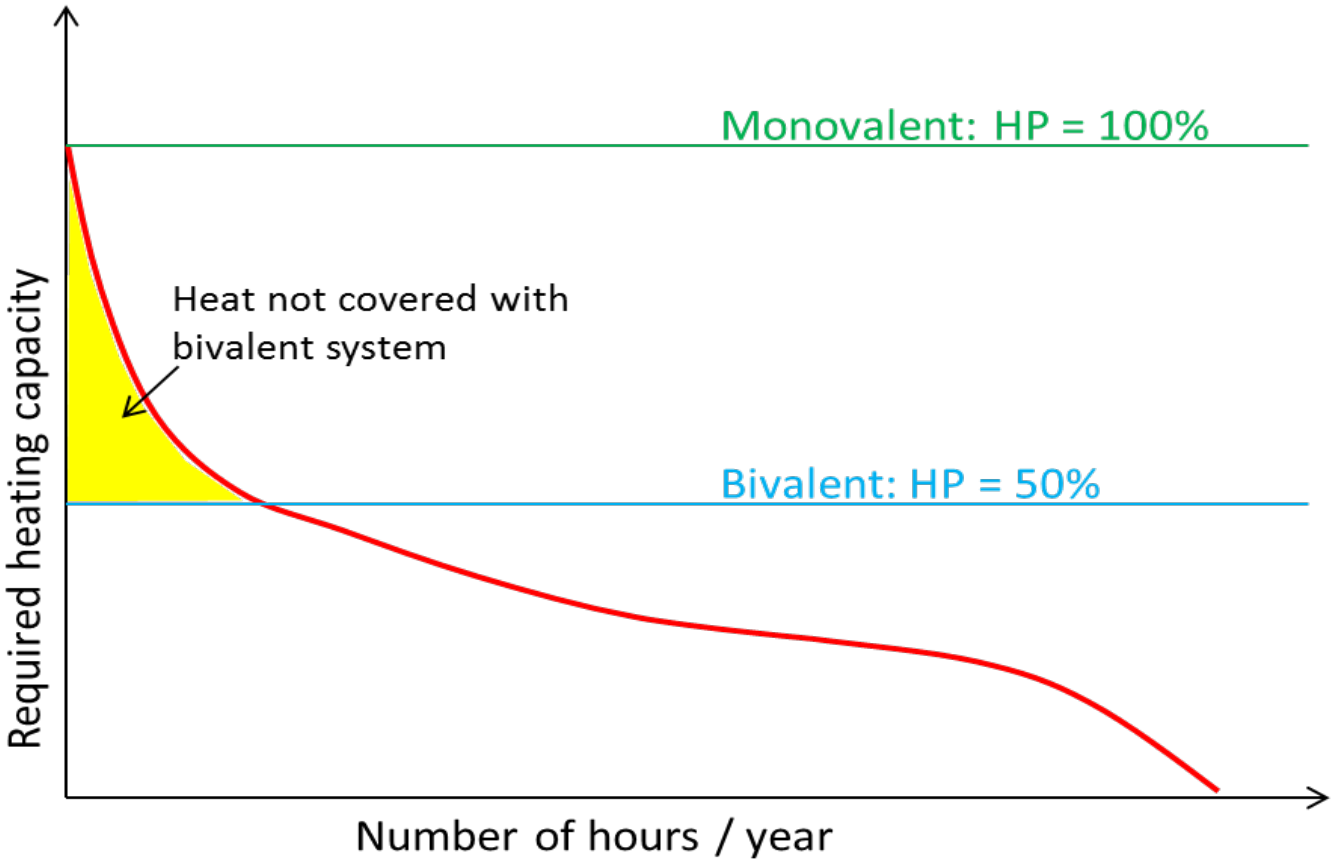
Der Geothermiekongress, Munich, 2019-11-19



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