

BENEFITS OF PE-X_a PROBES IN UTES APPLICATIONS

STEVE RICHMOND: 31.05.12

USING RAUGEO PE-XA PROBES IN UTES APPLICATIONS

AGENDA

Key benefits of PE-Xa probes:

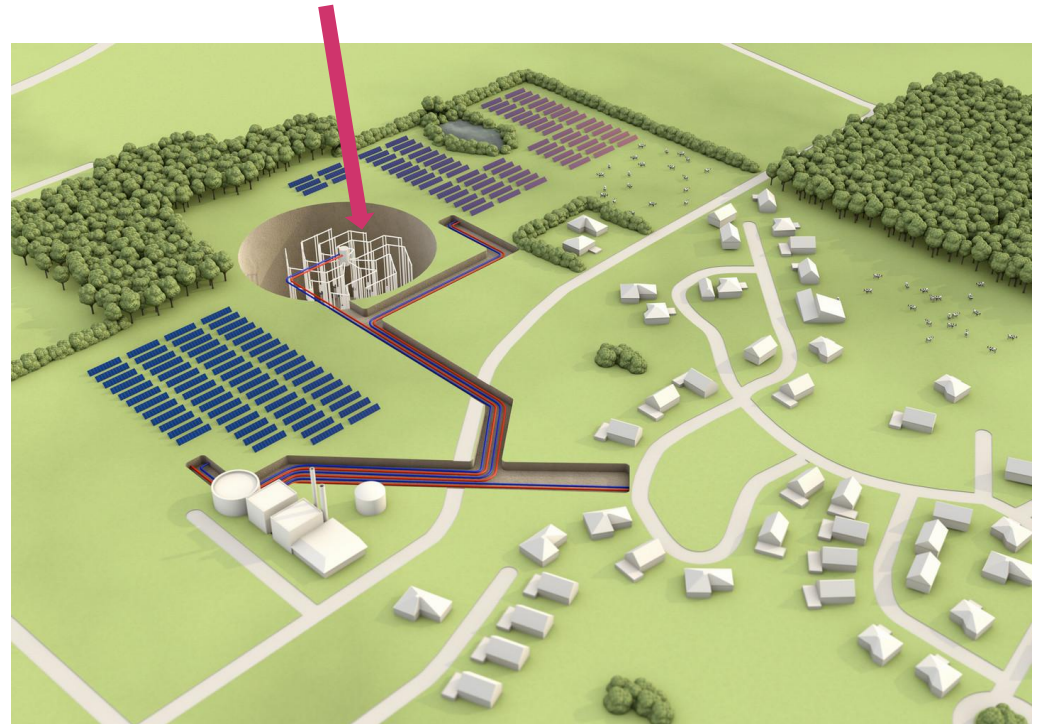
- Temperature resistance
- Bending radius
- Warranties
- Jointing technology
- Point loads

Other PE-Xa probe applications:

- HPR probes
- Infrastructure subsurface heating/cooling

Case studies

Borehole thermal energy storage (BTES)

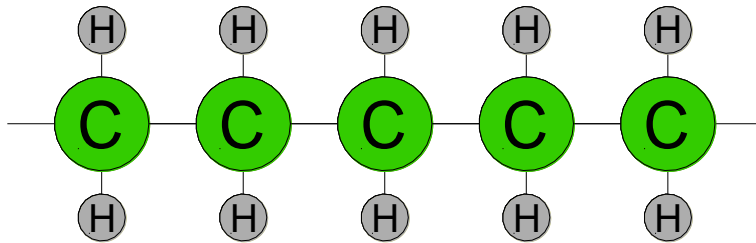


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CROSSLINKED POLYETHYLENE

PE-HD (PE 100)

- Long chains (approx. 70,000 Carbon atoms)
- Minimal branching

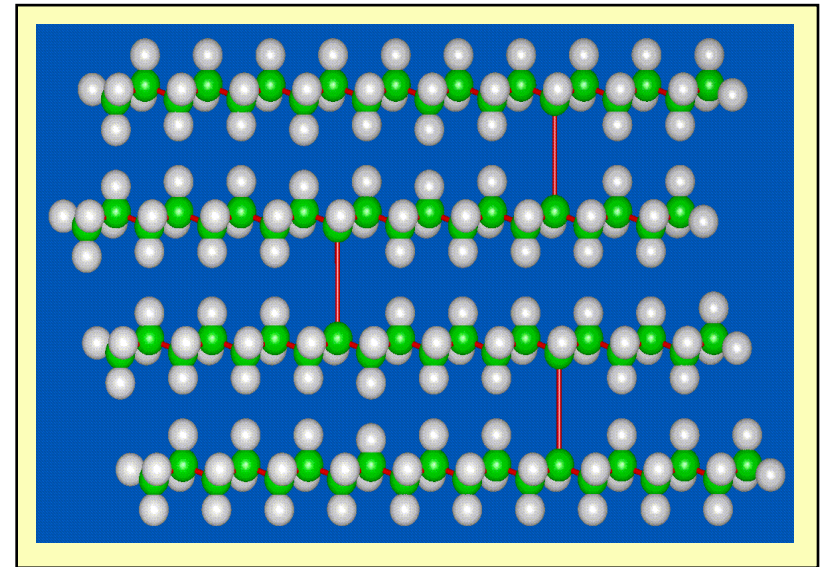


Molecular structure of PE-HD



PE-Xa (Cross-linked Polyethylene)

- Approx. 2 - 3 cross-link locations per molecule chain



Molecular structure of PE-Xa

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TEMPERATURE OF RESISTANCE OF PE-XA vs PE 100

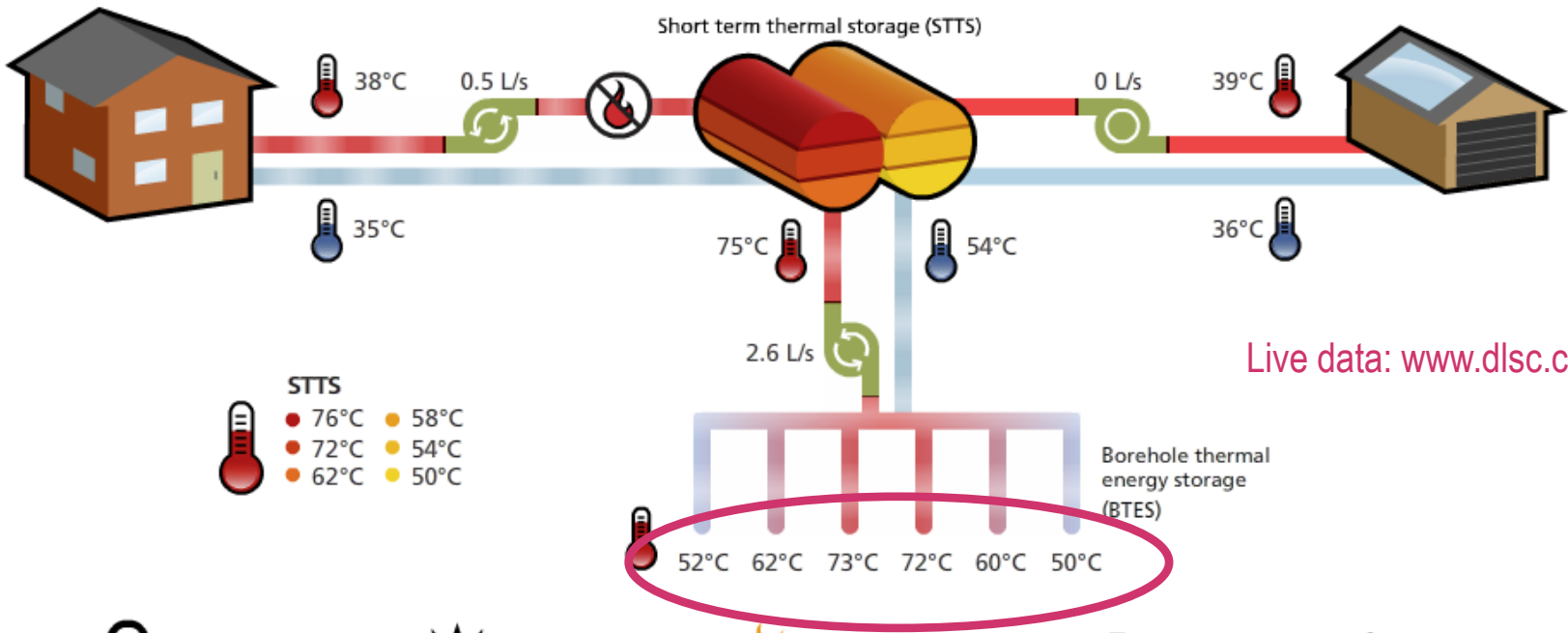
Durability (safety factor SF=1,25) Pipe SDR 11(25x2,3 and 32x2,9)			
PE-Xa		PE 100	
20 °C	100 year / 15 bar	20 °C	100 year / 15.7 bar
30 °C	100 year / 13.3 bar	30 °C	50 year / 13.5 bar
40 °C	100 year / 11.8 bar	40 °C	50 year / 11.6 bar
50 °C	100 year / 10.5 bar	50 °C	15 year / 10.4 bar
60 °C	50 year / 9.5 bar	60 °C	5 year / 7.7 bar
70 °C	50 year / 8.5 bar	70 °C	2 year / 6.2 bar
80 °C	25 year / 7.6 bar	80 °C	-
90 °C	15 year / 6.9 bar	90 °C	-



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TEMPERATURE OF RESISTANCE OF PE-XA vs PE 100

Current Conditions July 25, 2011 8:00



Live data: www.dlsc.ca

 Outdoor Temperature 16°C	 Incident Solar 94 W/m ²	 Solar Energy Collected 0 kW <small>x 798</small>	 Solar Fraction 100%	 Space Heating Load 7 kW <small>x 52</small>
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BENDING RADII FOR PE-Xa AND PE 100

Bending radius at given temperature	PE-Xa 25x2.3	PE 100 25x2.3	PE-Xa 32x2.9	PE 100 32x2.9	PE-Xa 40x3.7	PE 100 40x3.7
20°C	25 cm	50 cm	30 cm	65 cm	40 cm	80 cm
10°C	40 cm	85 cm	50 cm	110 cm	65 cm	140 cm
0°C	50 cm	125 cm	65 cm	160 cm	80 cm	200 cm

PE-Xa has $\geq 2x$ better bending radius than PE.

Minimum laying temperature: -30°C for PE-Xa
-10°C for PE 100

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PE-Xa PROBES

PE-Xa probes are possible with **no jointing**:

The flow and return of the probe form a **continuous circuit** without the potential damage point at the probe tip.

The probe tip can be coated in a special **fibreglass resin** to provide optimum reliability.



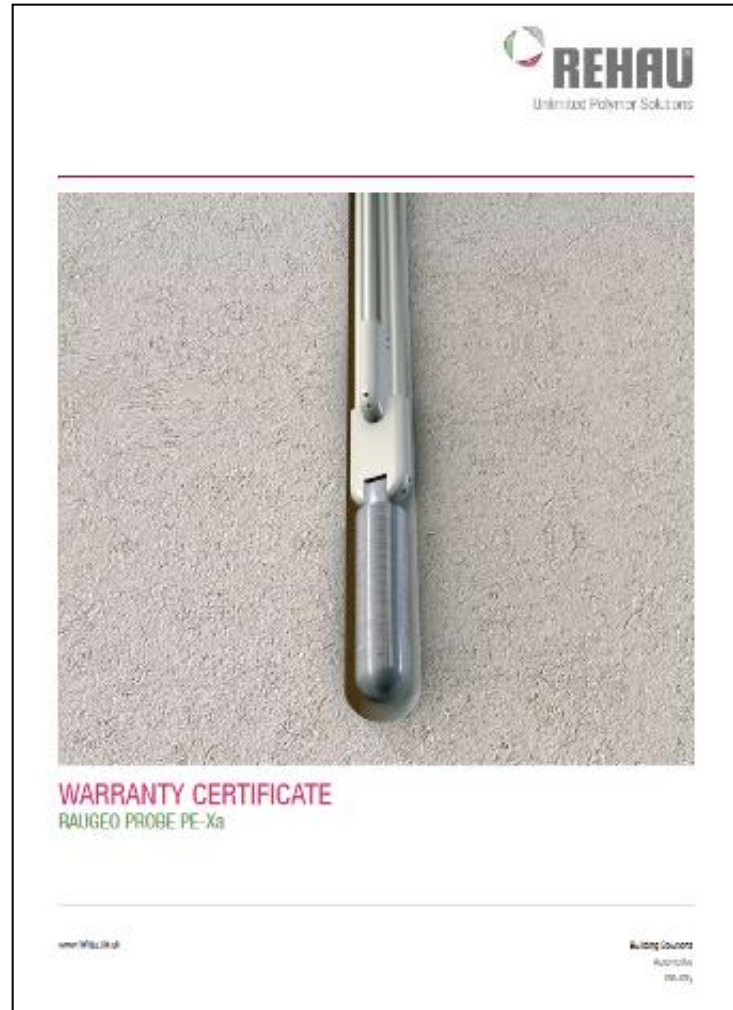
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10 YEAR WARRANTY

10 year consequential loss warranty for each PE-Xa probe installed

£10,000 cover per PE-Xa probe

Only possible on PE-Xa due to jointless probe tip



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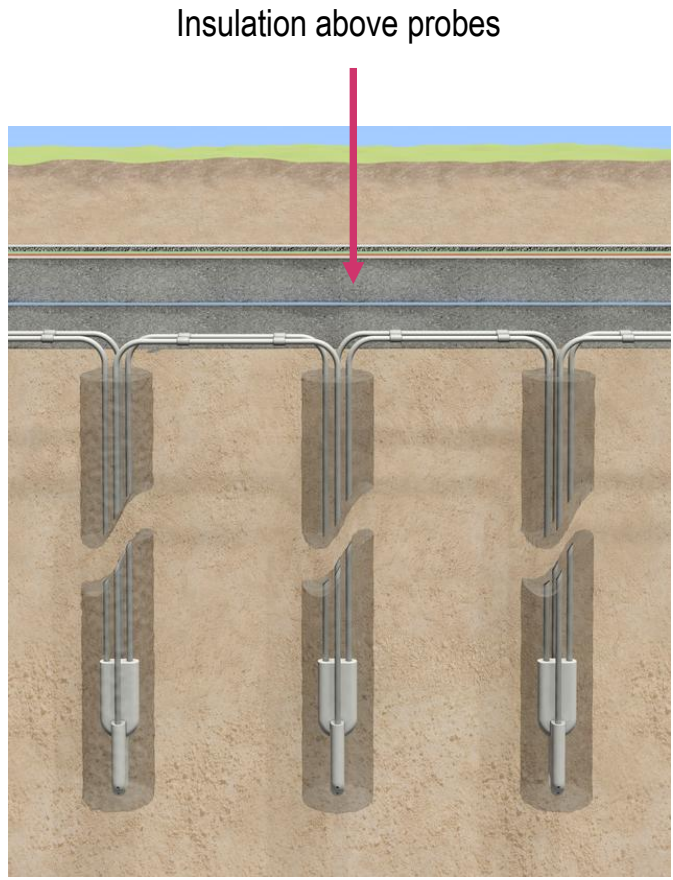
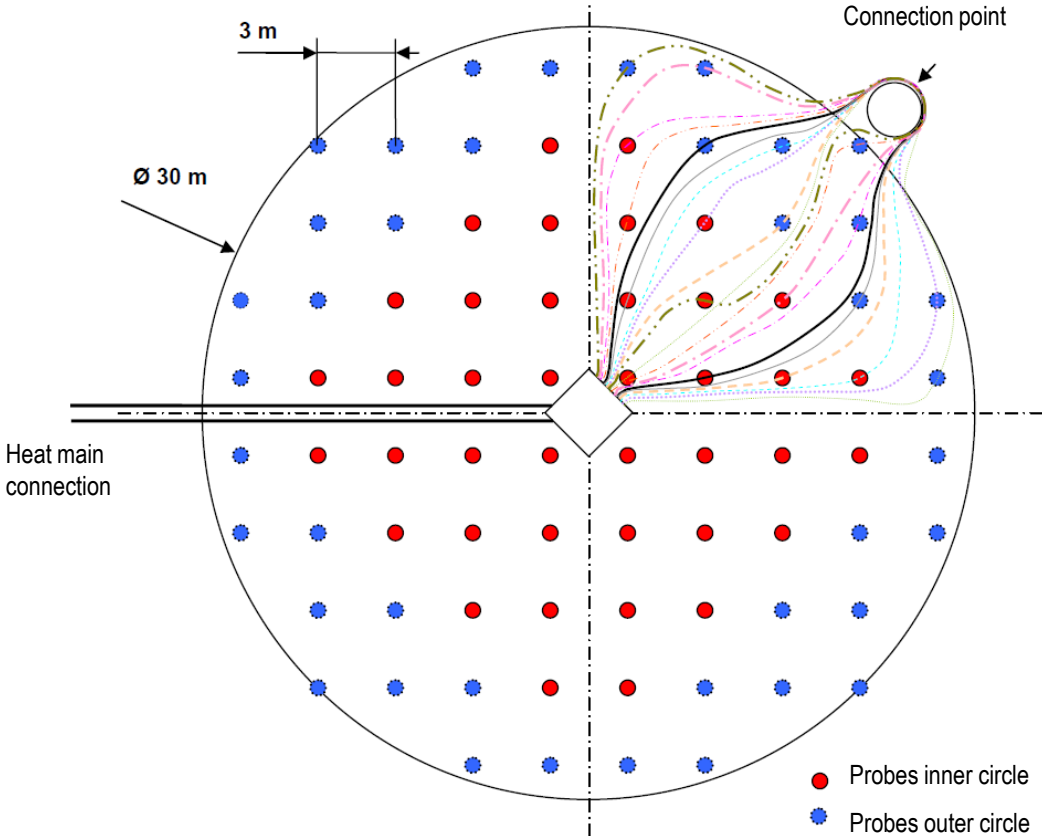
LEAKPROOF EVERLOC FITTING

- Only two components: **fitting and sleeve**
- Design takes material properties (**PE-Xa memory effect**)
- Ideal for below ground applications, as can be used in **all weather conditions**
- **>750,000,000** installations worldwide and no leaks



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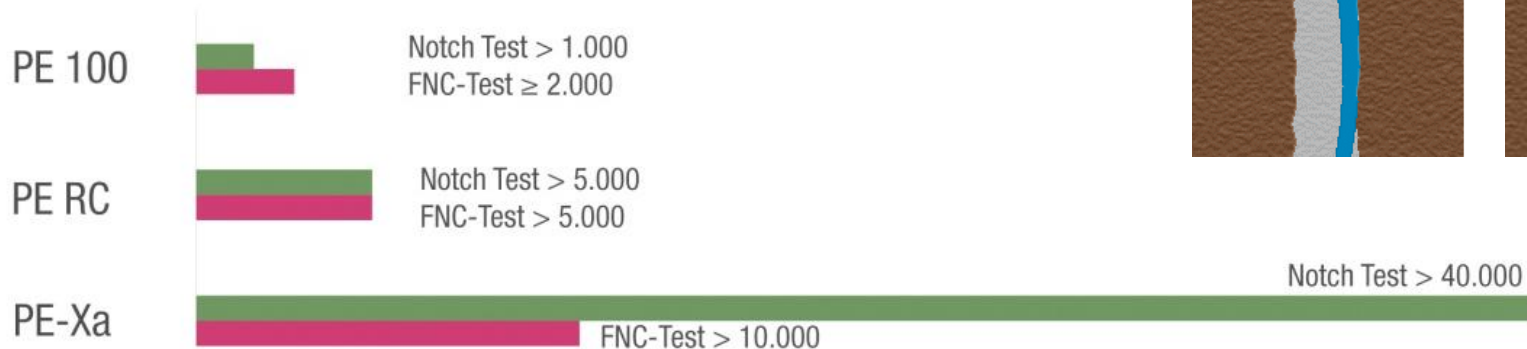
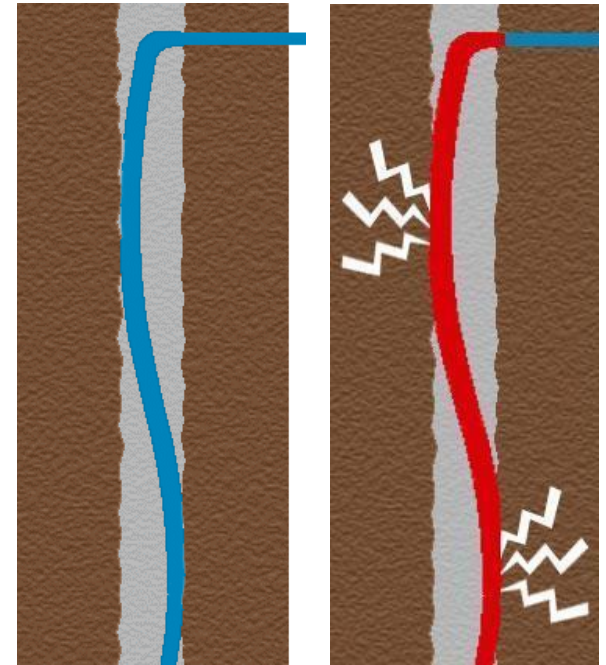
TYPICAL LAYOUT OF BOREHOLE FIELD



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POINT LOADS

- Point loads occur as the pipe presses against the borehole wall during installation & then thermally expands
- This can damage the pipe and in some cases, cause rupture
- PE-Xa is resistant to point loads



Test Results of Notch Tests & Full Notch Creep Tests (FNCT) in Hours

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HIGH PRESSURE REINFORCED (HPR) PROBES

RAUGEO HPR probes are designed for depths **up to 800m deep**.

- Able to heat commercial buildings **with just one probe**
- Steel reinforced PE-Xa pipe, **up to 120 bar**
- **Improves performance of GSHPs** with warmer ground temperatures (up to 35°C)
- **Coaxial** and **Double-U loop** variants

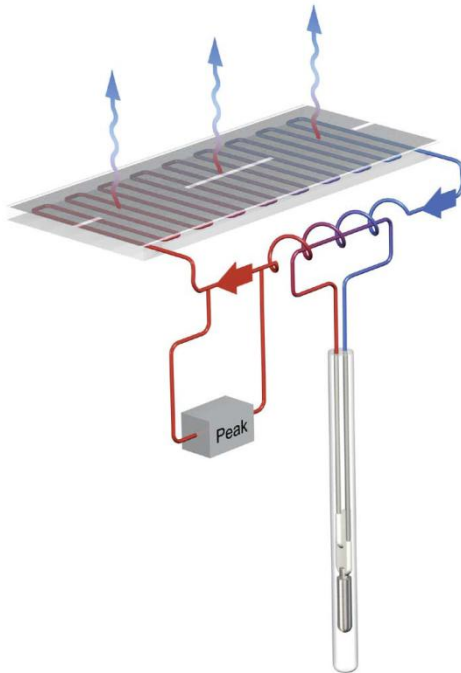
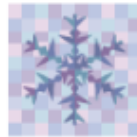


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INFRASTRUCTURE HEATING / COOLING

In **winter**, heat is extracted from the ground via probes and transferred to the road surface

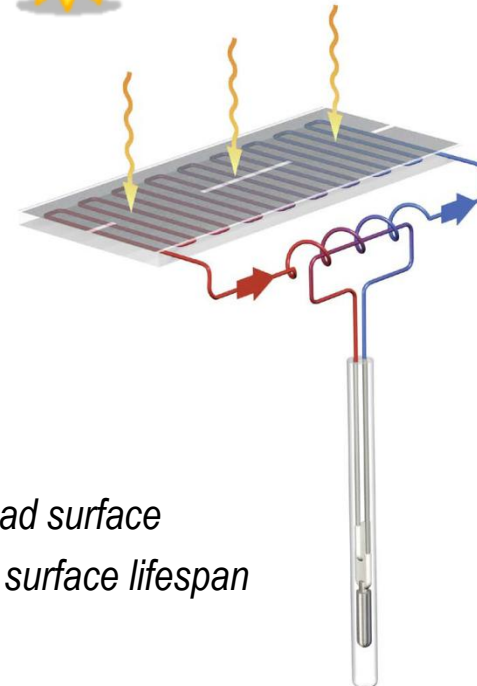
free from ice **or** free from snow
160 W/m² up to 300 W/m²



In **summer**, the traffic area acts as a solar thermal collector and the heat can be stored in the ground via PE-Xa probes.



Sun up to 600 W/m²



- Cools road surface
- Extends surface lifespan

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CASE STUDIES – UTES

Solar Storage Crailsheim, Germany

System description

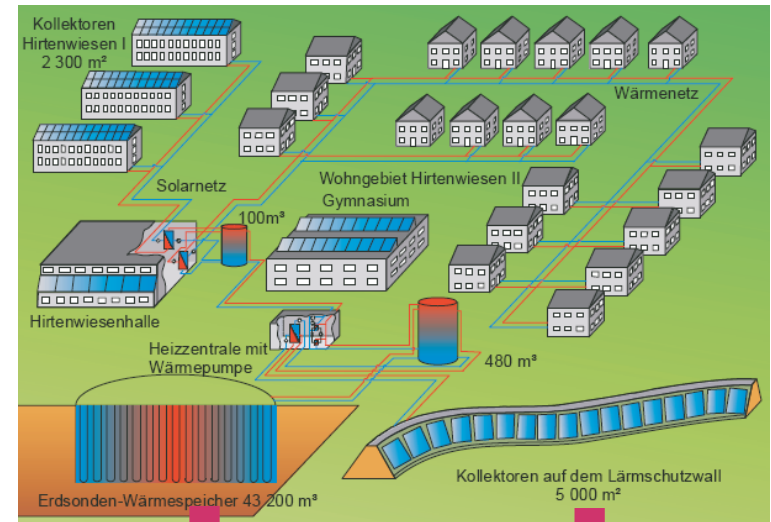
- 260 dwellings, school, sports hall
- 4100 MWh/a with network temperatures flow/return 65/35°C

Heat sources:

- 7,300m² solar collectors with 5,1MW peak output
- 750 kW heat pump
- Supplementary heating through district heating network

Heat storage:

- 100m³ high temperature peak load storage (hot water)
- 480m³ buffer storage (hot water)
- 43,200m³ ground-source probe underground storage (80 PE-Xa probes)



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CASE STUDIES – UTES

Braedstrup District Heating & Solar Park, Denmark

System description

- 1,400 homes
- DH network owned by community
- 6MW system (3,800 MWh/a)

Heat sources:

- 16,000m² solar collectors
- Heat pump
- Peak heating through district heating network

Heat storage:

- 2,500m³ buffer tank(hot water)
- 50 PE-Xa probes at 50m deep



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CASE STUDIES – UTES

Drakes Landing Solar Community, Okotoks, Canada

System description

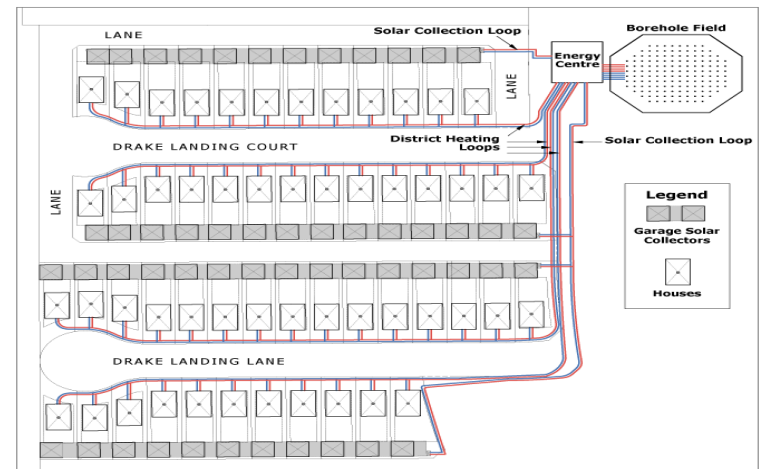
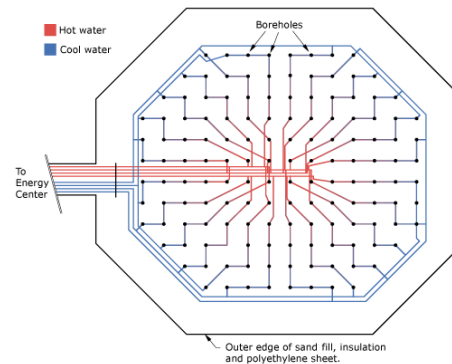
- 52 house community

Heat sources:

- 800 solar thermal collectors (ca. 2300m² area)

Heat storage:

- Borehole thermal energy storage of 144 x 25mm PE-Xa probes at 35m depth



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CASE STUDIES – UTES

ASKAP Telescope – Western Australia

- Fully off-grid installation – GSHP used 100% for cooling
- 98 x 32mm PE-Xa probes, each 125m long (48°C estimated flow temp)
- 7,800m of RAUGEO pipe to connect boreholes
- 12 medium manifold chambers



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CASE STUDY – PLATFORM HEATING

Platform Heating Bad Lauterberg, Germany

Objective:

Keep platform free from snow & ice

2 platforms measuring 150 x 2.5m, using platform boards 2.5m²

Each board has 25m of RAUGEO stabil pipe included.

Heat storage:

9 ground-source probes at 200m

Connected via RAUTHERMEX

Operational since 2005: concept proven over several winters





THANK YOU FOR YOUR ATTENTION – ANY QUESTIONS?

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