



Rialtas na hÉireann
Government of Ireland



Geological Survey
Suirbhéireacht Gheolaíochta
Ireland | Éireann

Session 1: Decarbonising public sector buildings with geothermal heat

Chair: Dr Sarah Blake, GSI



Session 1

Session 1 – Decarbonising Public Sector Buildings with Geothermal Heat

	Chair – Sarah Blake , <i>Geological Survey Ireland</i>
10:40	Introducing the Dublin City Geothermal Working Group Sarah Blake , <i>Geological Survey Ireland</i>
10:50	Geothermal case study: Trinity College Dublin Rubrics Retrofit Peter Breen , <i>Trinity College Dublin</i>
11:05	Delft Subsurface Urban Energy Lab: TU Delft campus geothermal heating Phil Vardon , <i>TU Delft</i>
11:20	Panel discussion Mark Geraghty , <i>TU Dublin</i> Alan Sharp , <i>CEO Mater Hospital</i> Vincent Brennan , <i>HSE</i> Edel Wyse , <i>Carbon Energy Fund Ireland</i>

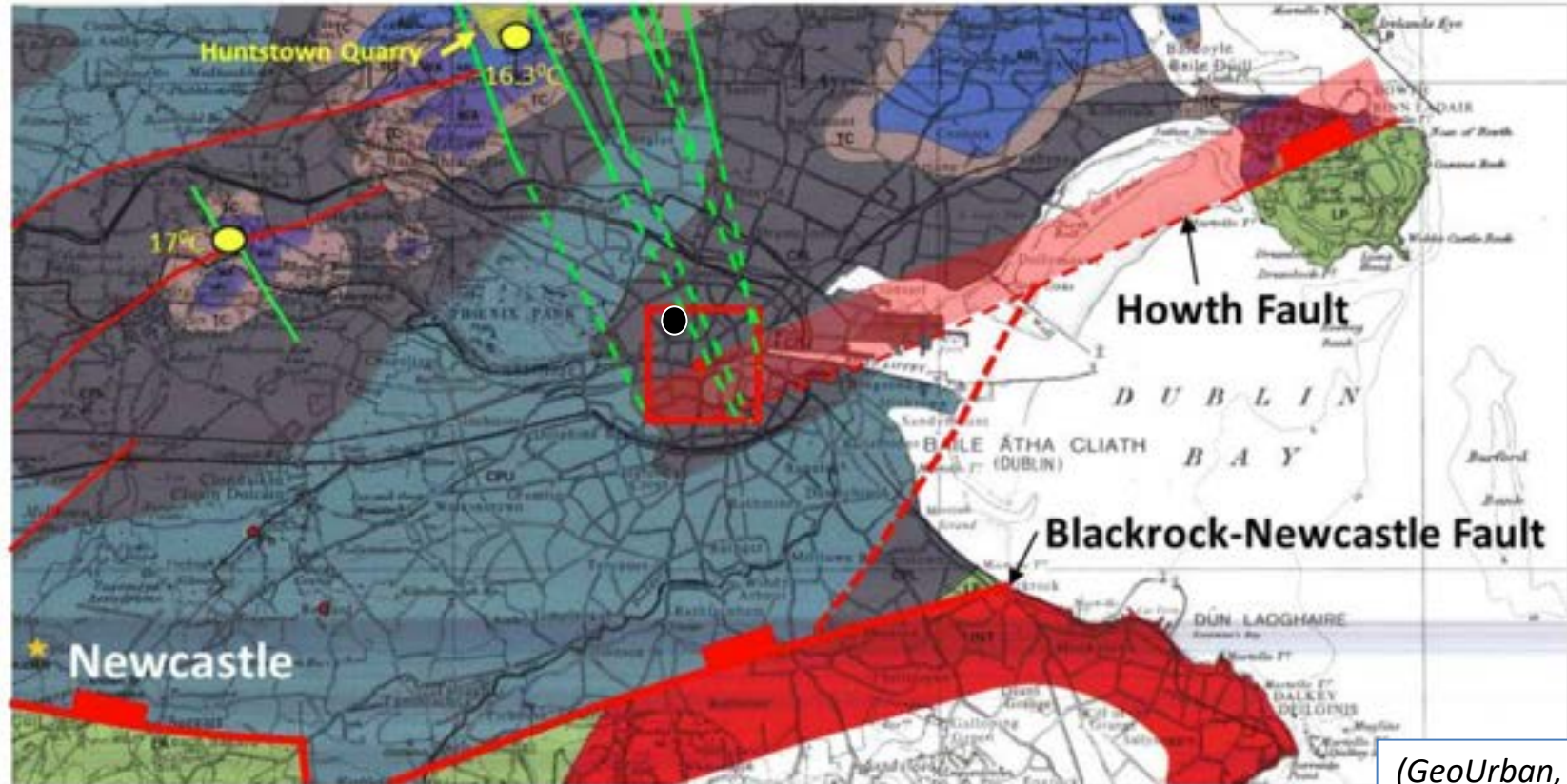
12:00 Coffee & Tea Break

GSI's Geothermal Programme

- Active since late 1990s
- Part of Groundwater & Geothermal Unit
- Developed GSHP suitability maps in 2015
- Now expanding the National Geothermal Database (current phase 2021 – 2025)
- Funders of external research
- Provide technical support for geothermal policy and decision-making
- Outreach
- Seeking funding for public demonstration projects

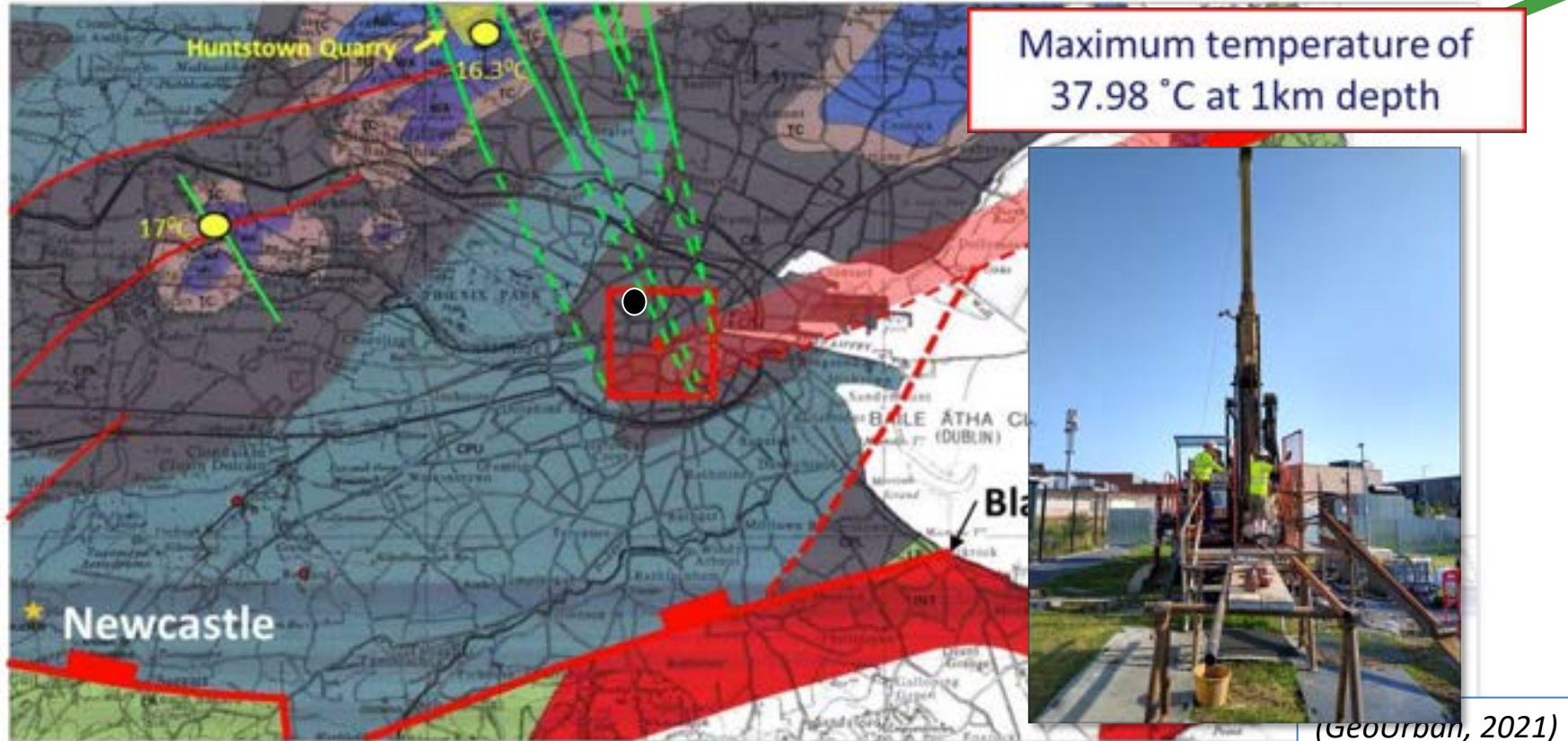


A geothermal demonstrator in Dublin City?



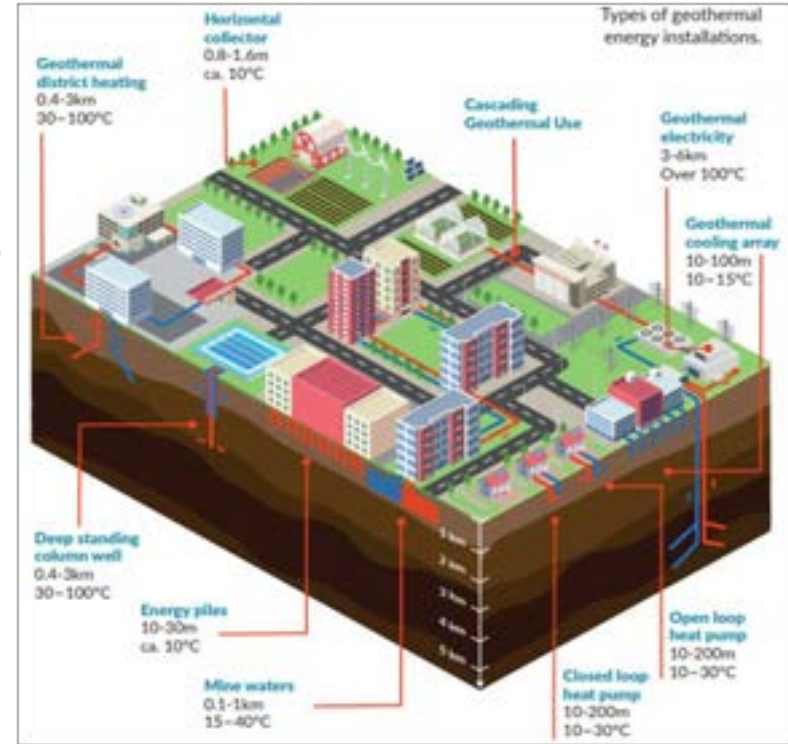
(GeoUrban, 2021)

A geothermal demonstrator in Dublin City?



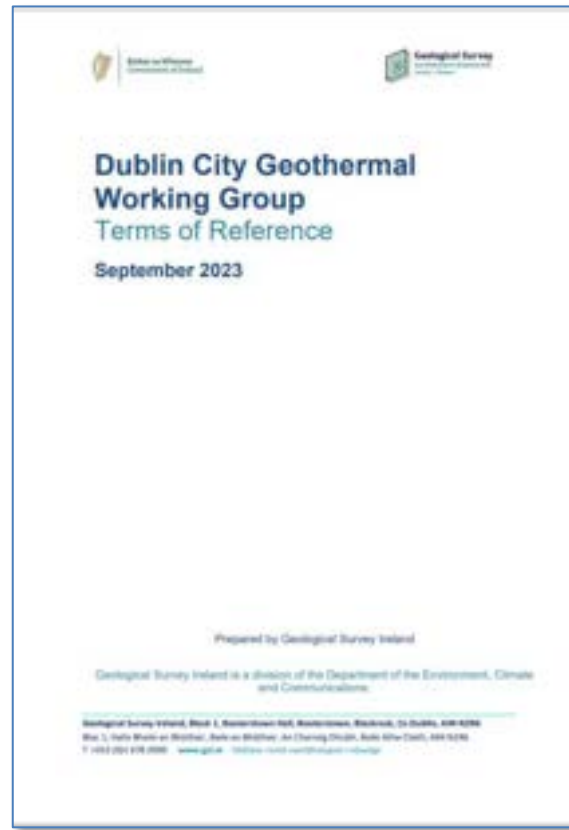
Dublin City Geothermal Working Group

- Formed September 2023, launching today!
- Will *"unite a diverse group of organisations with the common aim of delivering geothermal demonstrator projects in Dublin City"*
- Urban university and hospital campuses *"require a renewable source of energy that is secure, economical, and environmentally sound for both new builds and the retrofit of existing buildings (some of historical significance)"*



Dublin City Geothermal Working Group

- Membership consists of public sector experts in the areas of district heating, geothermal energy, procurement, and the financing, management and delivery of large infrastructure and energy projects
- Subsurface data collection programmes will be required to de-risk large-scale geothermal projects in Dublin City
- GSI will chair the WG



Dublin City Geothermal Working Group



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An Roinn Comhshaoil,
Aeráide agus Cumarsáide
Department of the Environment,
Climate and Communications



**Grangegorman
Development Agency**
Gníomhaireacht Forbartha
Ghráinseach Ghormáin



**Mater Misericordiae
University Hospital**





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Presentations

Rubrics Building (1699)

- Accommodation 1,715m².
- **Design process:**
 - Fabric upgrade achieved a passive energy reduction of 40% through floor, roof and wall insulation.
 - Feasibility study to establish optimum heating strategy.
 - Options appraisal of CHP, ASHP, GSHP
 - GSHP was chosen:
 - Lowest running cost
 - Lowest CO₂ emissions
 - Highest renewable energy contribution
- **Geothermal Design:**
 - Initial concept design: collector layout
 - Site specific assessment: 1 no. test hole 150m deep.
 - Thermal response testing using test rig. 9 kW heat.
 - Predictive and thermal modelling of ground loop and building.
 - Final collector design.



- **Geothermal:**

- Boreholes at 8m spacing grid.
- Closed loop collector system of 21 nr. 175m deep vertical boreholes.
- Total collector length of 3,700m
- Area of approximately 2,300m².
- Double-U probes within thermally enhanced grout.
- Avoiding tree roots
- Ground water at 9-12°C is used in 3nr. 63kW GHSPs.

- **Results:**

- Performance of the borehole array has been as predicted.
- We predict 75% reduction in primary energy and CO₂ emissions.
- Currently at measurement & verification stage

- **Outcome:**

- We've proven it's possible to do a carbon reduction retrofit on a historic building which has conservation



Decarbonisation Targets

- The challenge is to decarbonise the GHG emissions from heat.
- The annual heating load of our island campus is 21 million kWh.
- West End historic buildings are heated on a medium temperature district heating system by a 2 MW boiler.
- Age of our estate and conservation limits fabric improvements possible.
- We need a range of solutions to help us meet our GHG target.
 - Space
 - Delivers the temperatures we require
 - Geothermal and ground source has a role.
 - Evaluating whether feasible to recommission an open loop shallow well design GSHP at the O'Reilly building 1990.



Scaling this up across the campus?

- Rubrics building floor area is 1,715m². Size of the borehole array required to heat Rubrics is 2,300m².
- Main Campus floor area is over 230,000m².
- Can we heat our whole campus through similar 175m deep ground source arrays?
- Not enough ground space!



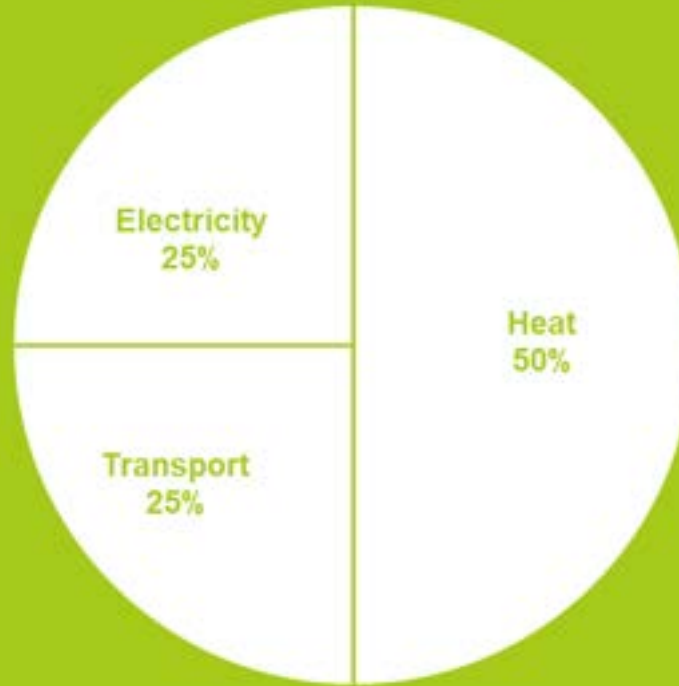
Challenges & Solutions:

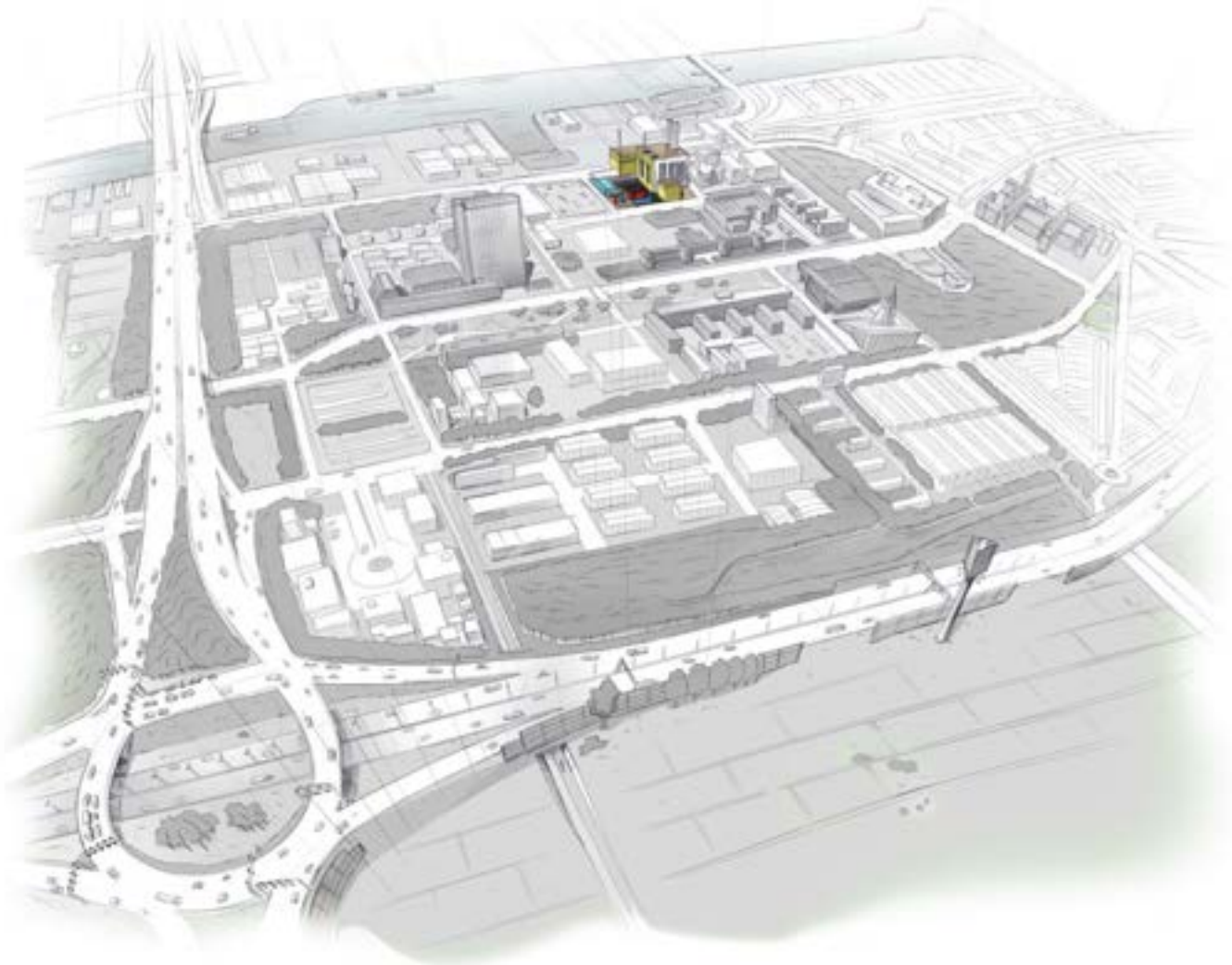
- **Space:**
 - 170m arrays may be part of our decarb solution, meeting the heat requirement of some buildings.
 - Deep geothermal occupies less space per MW of heat.
- **Technical:**
 - Deep geothermal allows us access hotter ground water.
 - The TUD and other research projects under way will provide better information.
- **Financial:**
 - Higher Capex required for ground source heating.
 - Collector is an asset to the building for ~ 50 years. ASHP life is only 20 years.
 - How do we accurately predict costs of deep geothermal to allow financial options appraisal?
- **Dublin City Geothermal Working Group**
 - Trinity can contribute into research.
 - Our O'Reilly building had one of the first GSHPs (1990) in Ireland. Shallow well. Now being re-evaluated.
 - Input into solving the regulatory challenges
- Site visit at 9.30am tomorrow for those who'd like to see it. Please notify the conference organisers if wish to attend.

Delft Subsurface Urban Energy Lab:
TU Delft campus geothermal heating

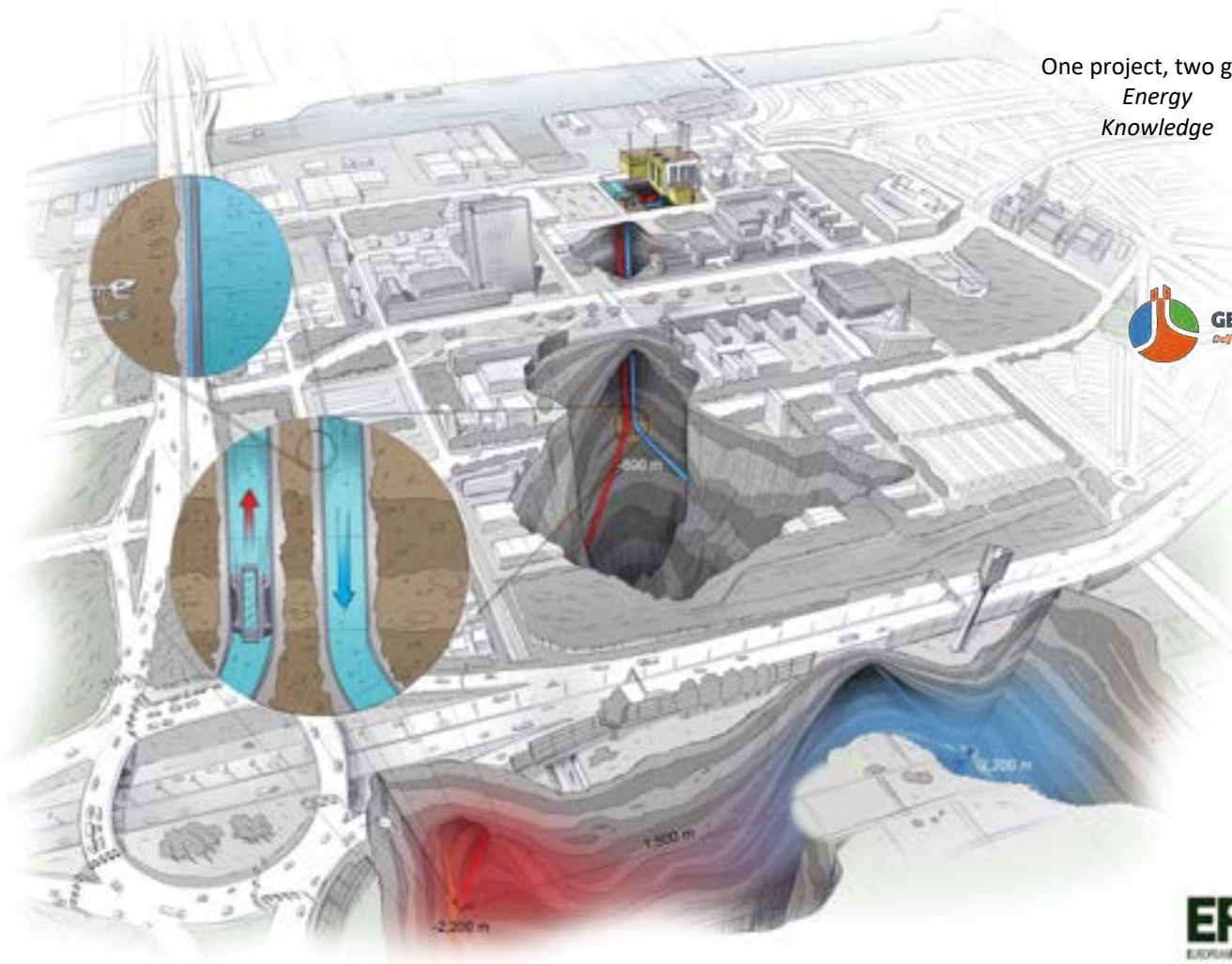
Phil Vardon
and many colleagues

ENERGY CONSUMPTION IN NETHERLANDS





One project, two goals
Energy
Knowledge



GEOTHERMIE DELFT
Delftse Area van duurzame energie en kennis



ebn

TU Delft





Research questions



How much energy can be delivered?

What is the long term flow and heat flow behaviour?

Reliable predictions, interference

Safe operating windows

How can we best monitor geothermal projects?

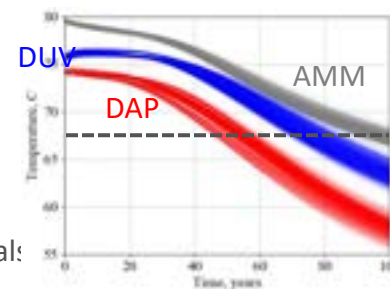
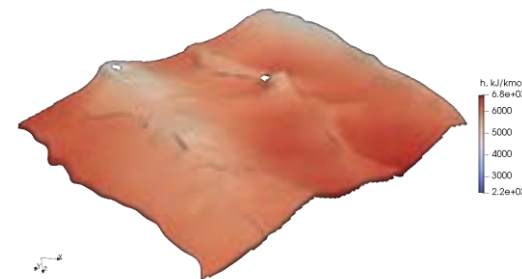
For energy production

For surface impacts.

How do (new) materials behave / perform?

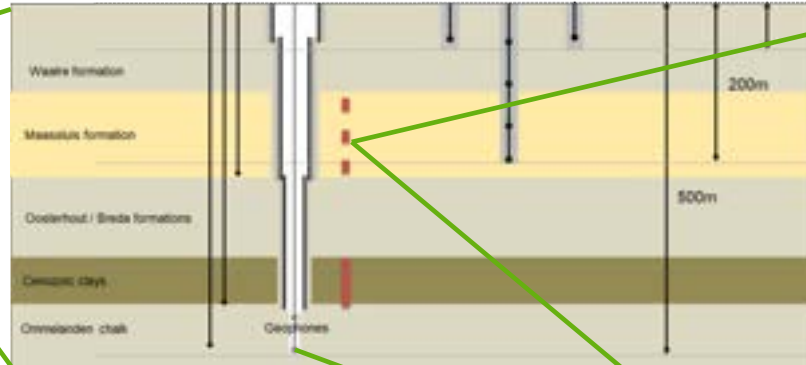
Reservoir variability / heterogeneity

Geothermal fluids, geochemical processes, engineered material:



Monitoring, exploration of shallow subsurface

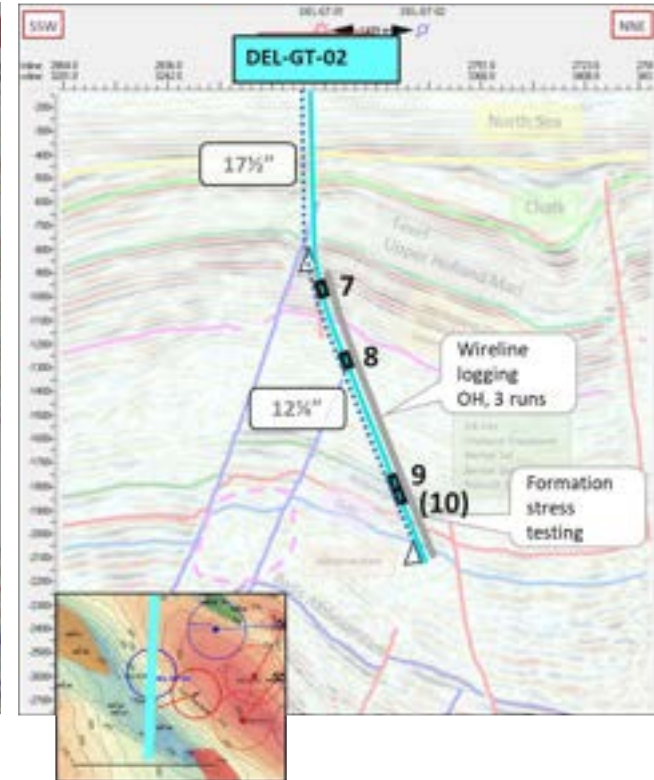
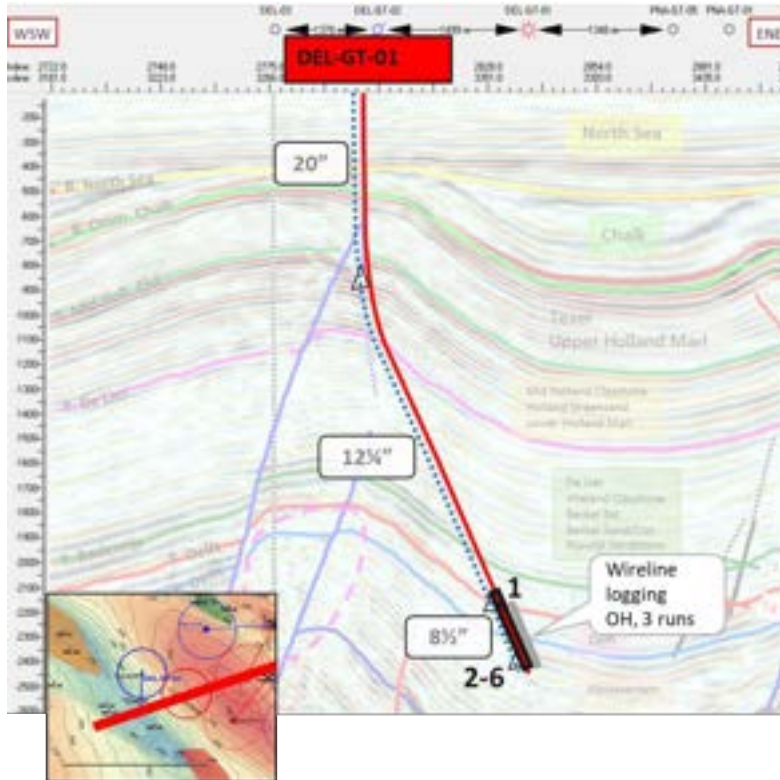
Data available: <https://doi.org/10.4121/21640148.v2>



<https://www.knmi.nl/nederland-nu/seismologie/stations/live-seismogrammen>



Coring, logging





Lower Rodenrijs
claystone



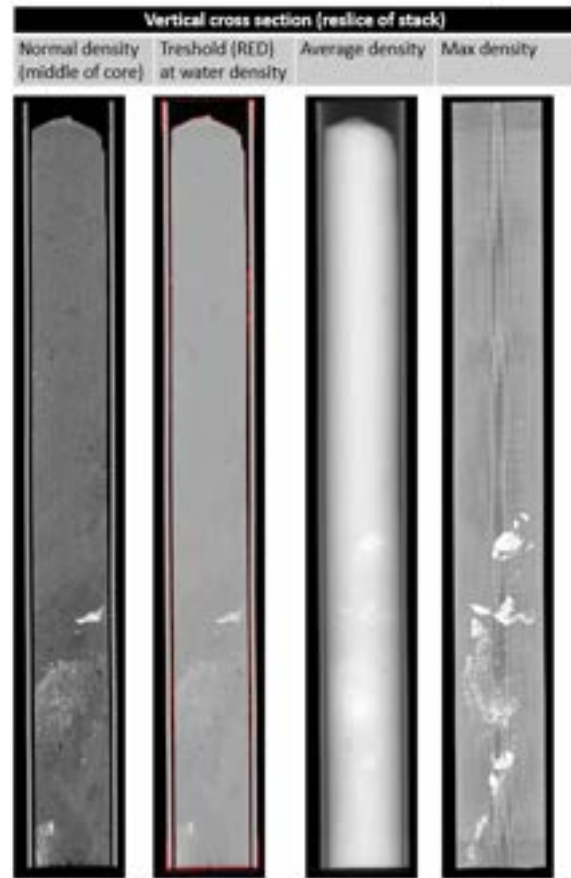
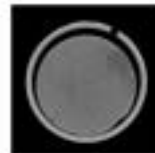


Core preservation



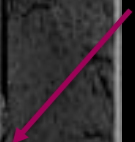
CT scanning in GSE laboratory

DELGT01-C1-1

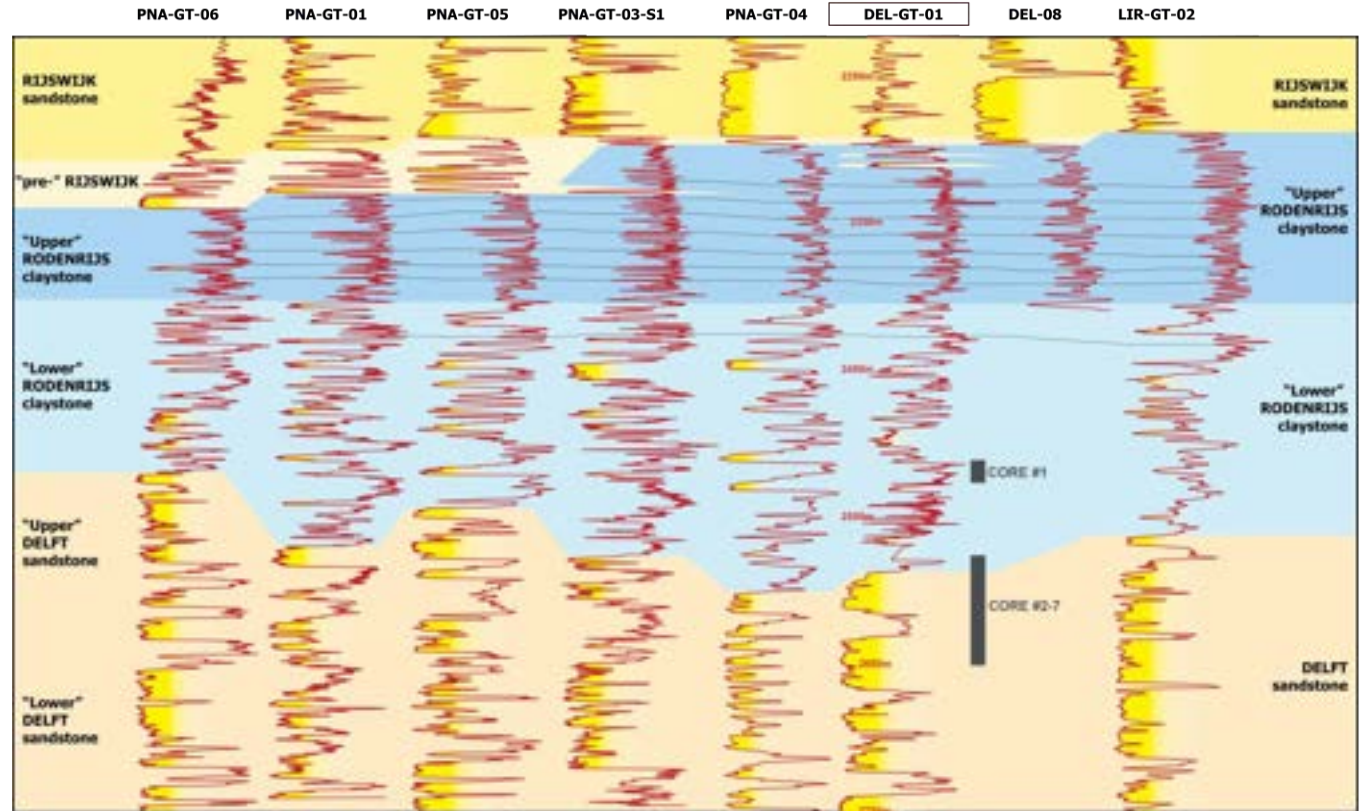


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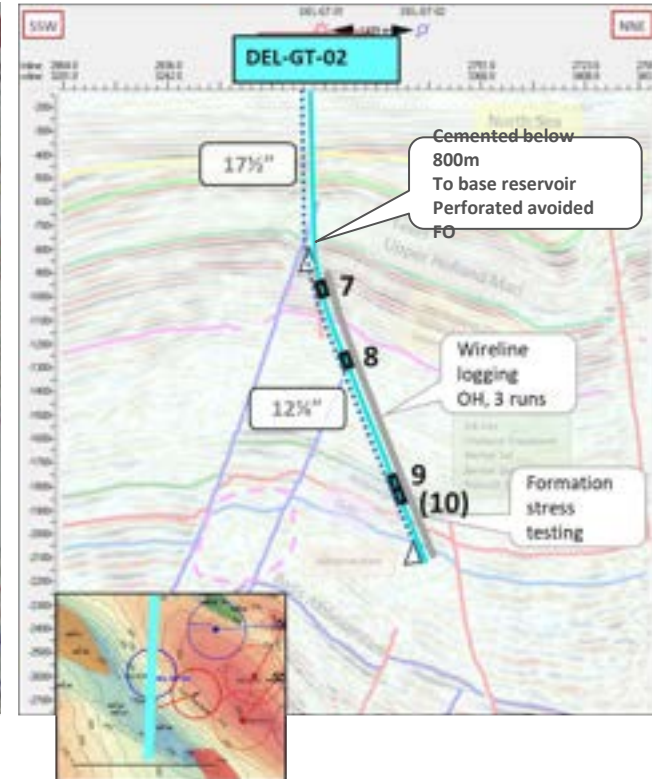
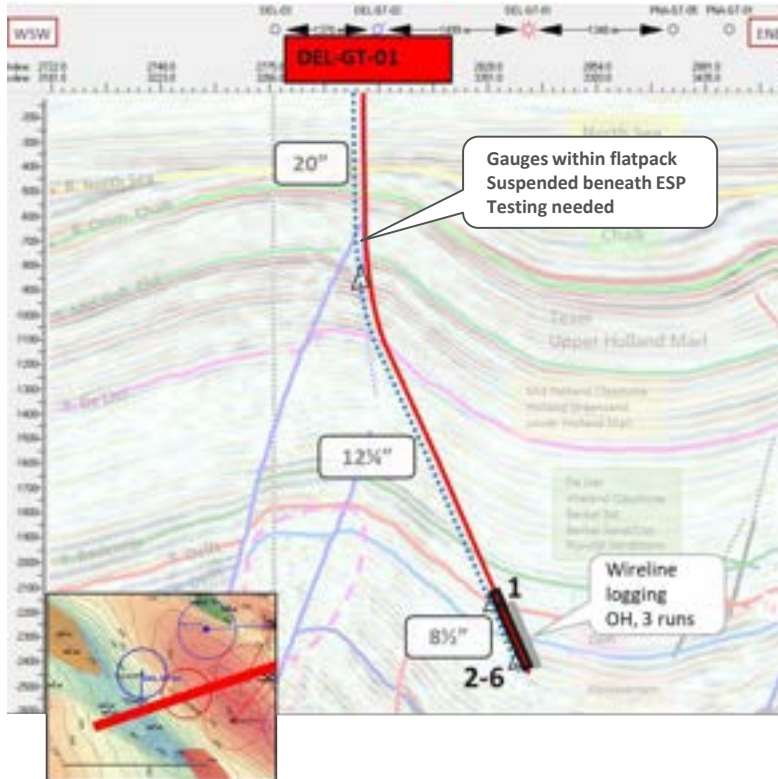
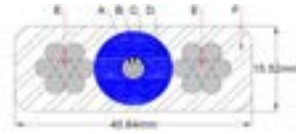
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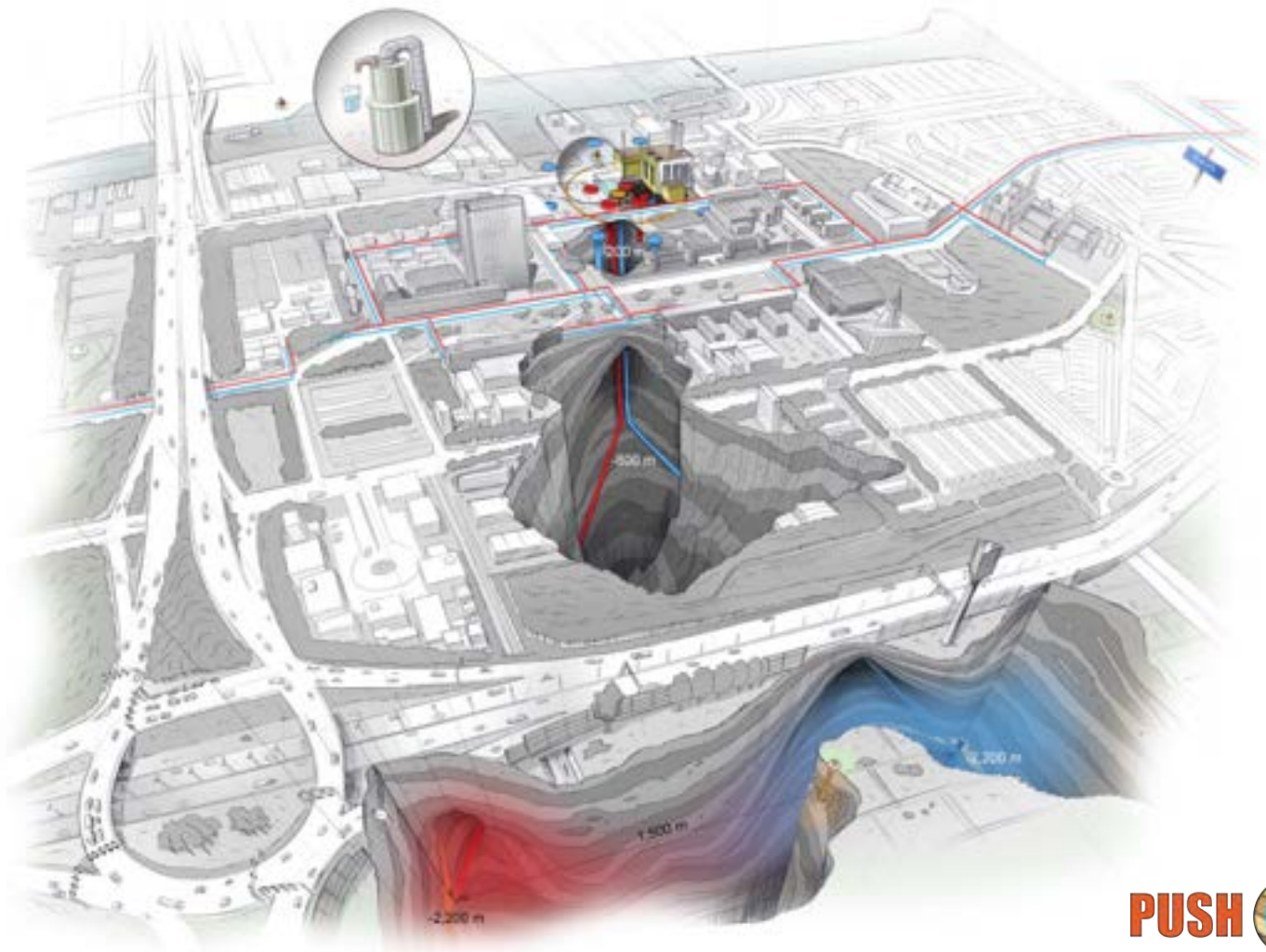


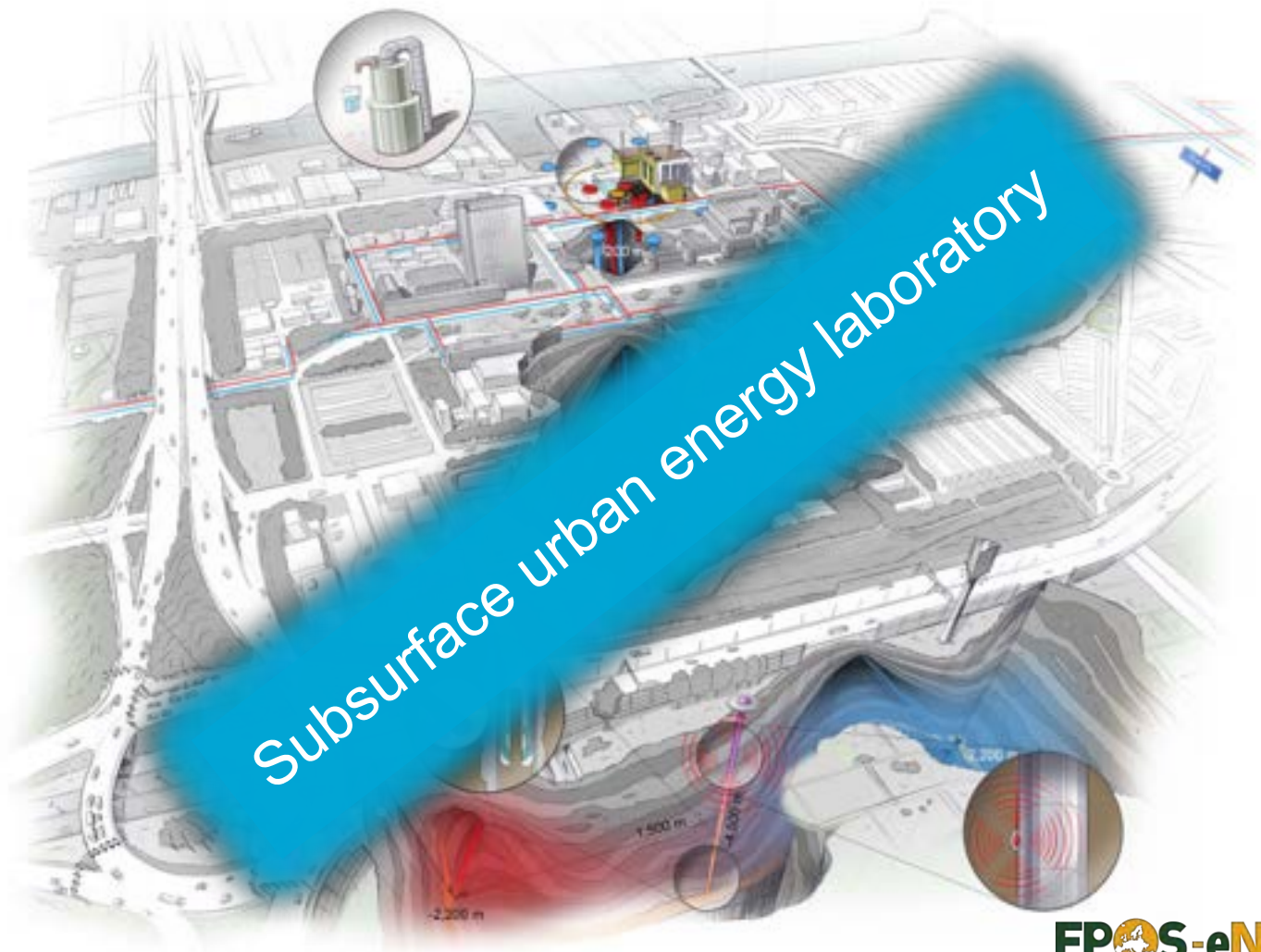
Reservoir variability



Fibre optics







People care: energy and science



Electrical Energy track



Wind Energy



Solar Energy



Waste & CHP



Energy Storage



Power Engineering



Economics & Society



Electric Mobility

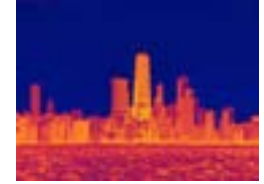
Heating and Cooling track



Heat Sources



LS Heat Systems



Heat in Buildings



Power Engineering



Economics & Society



Waste & CHP



Solar Energy

NEW!!
1-9-'23

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