UNITED DOWNS

DEEP GEOTHERMAL POWER

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GeoScience Ltd

Acknowledgements

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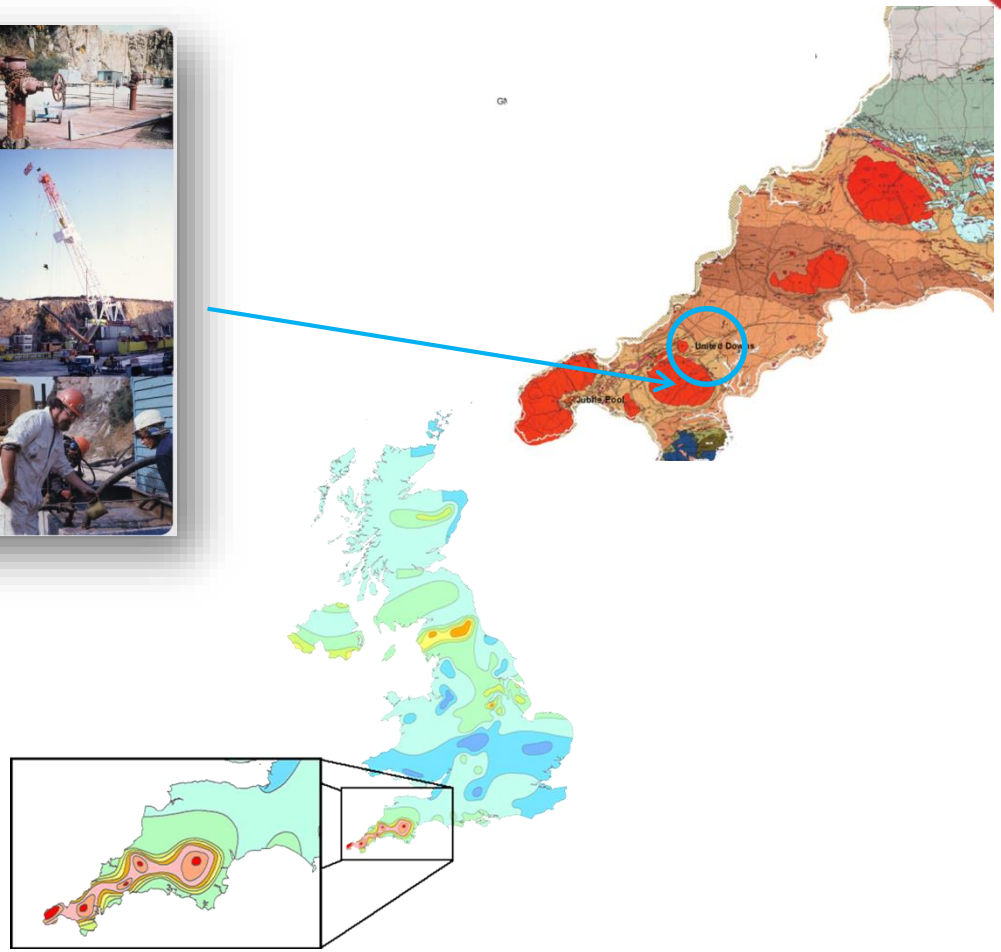
European Regional Development Fund
Cornwall Council

The work presented here was carried out by the UDDGP project team, comprising staff from:

Geothermal Engineering Ltd
GeoScience Ltd
British Geological Survey
University of Plymouth

And numerous contractors and service providers

Cornwall's geothermal resource



The granites beneath Cornwall are a significant, heat-producing energy source

Concepts HDR >> EGS >> UDDGP

How did we get here?

Original UDDGP project concept

2009

Site and planning permission

2010

Hot Dry Rock … unfinished business

2011

Attempt to secure funding for Phase 1 (drill and test a first well)

2012

2013

Project planning, promotion and lobbying. Lots of interest, but no money .

2014

Change of emphasis....

2015

DCLG / ERDF Funding Call

2016

Funding Agreement

2017

Drilling

2018

2019

2020

Funding calls

ERDF Priority Axis 4 Supporting the shift towards a low carbon economy in all sectors – renewable sources and low carbon technologies

Drill a commercial-scale demonstration well in Cornwall to explore and characterise the deep geothermal resources

Cornwall Council

"Create an energy future that is cleaner and more affordable, retaining social and economic benefits in the county"

Provide 100% of the county's electricity demand from renewables and (since January 2019) become carbon neutral by 2030

Reduce fuel poverty
Locally owned generation
Green jobs

Reduce the risk to potential future investors

UDDGP proposal

	In order to…..
Drill and test a deep hole, as set out in the funding call	Explore and characterise the deep geothermal resource
Drill and test a second, shallower hole, establish a circulating system and build a demonstration power plant	Test the geological, technical and financial concept, reduce investor risk, speed up the transition to development of commercial systems …. To prove that geothermal power generation in Cornwall is possible
Dissemination, community outreach, education	Transfer knowledge to businesses, regulators, educational institutions and the public
Parallel research programme looking at public perception, acceptance and understanding of geothermal in Cornwall	Address the potentially significant issue of public concern and opposition

Programme

Preparation	June 2017 – October 2018
Drilling	November 2018 – June 2019
Evaluation	March - June 2020
Power plant	~~3rd quarter 2021~~

Community outreach
Education programme
Social research

Postponed until we can resume site activity

ERDF (via MHCLG)	£10.6m
Cornwall Council	£2.4m
Private	£5m

Power plant

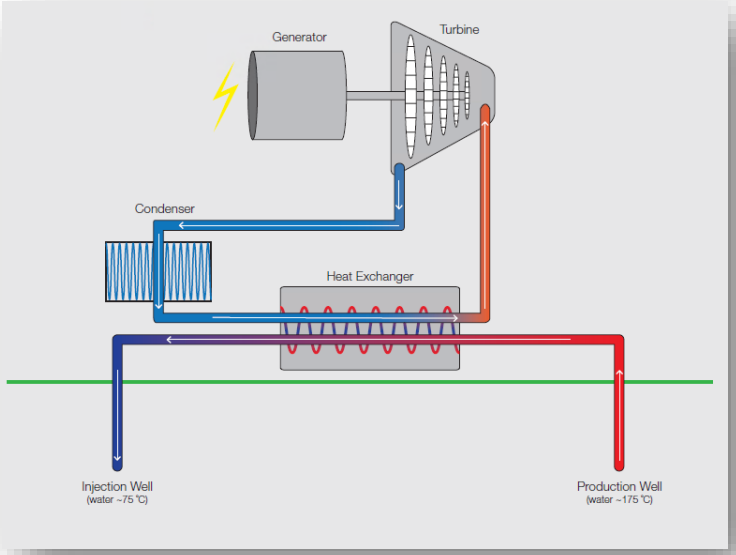
Base case is 1MWe (~20l/s, 175°C)

Estimated Greenhouse gas reductions ~3,400 Tonnes/year CO_2

4 – 5 MWe

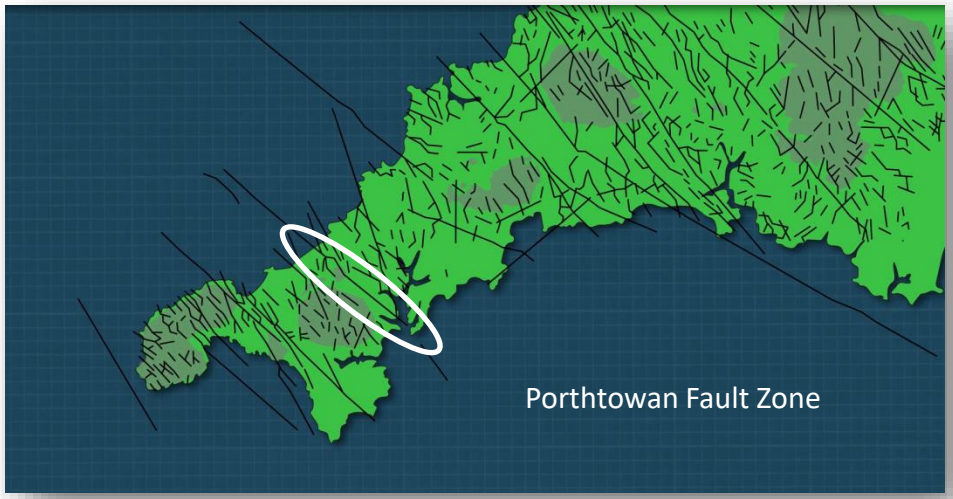
Possible expansion to 3MWe, depending on well performance and availability of additional funding – enough to supply about 3,000 homes

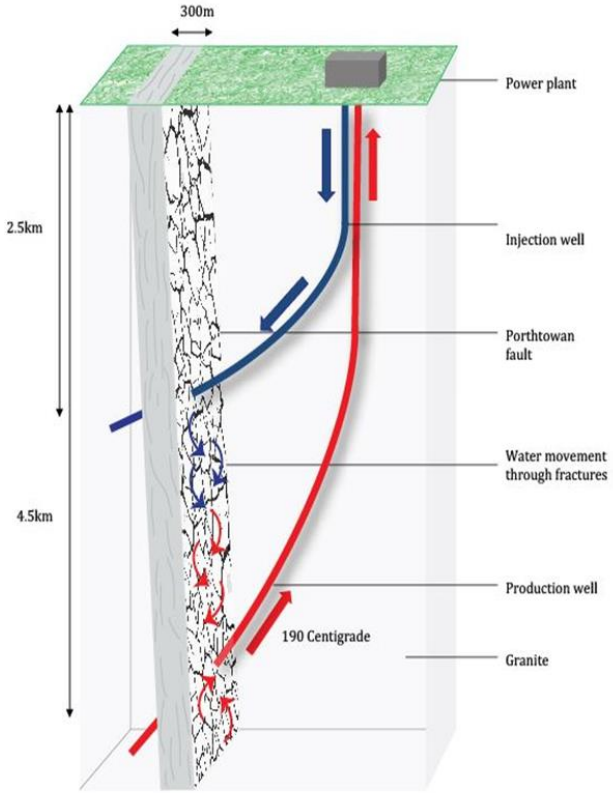
3MWe is the limit of our grid connection



UDDGP Concept

Natural permeability in a target fault structure



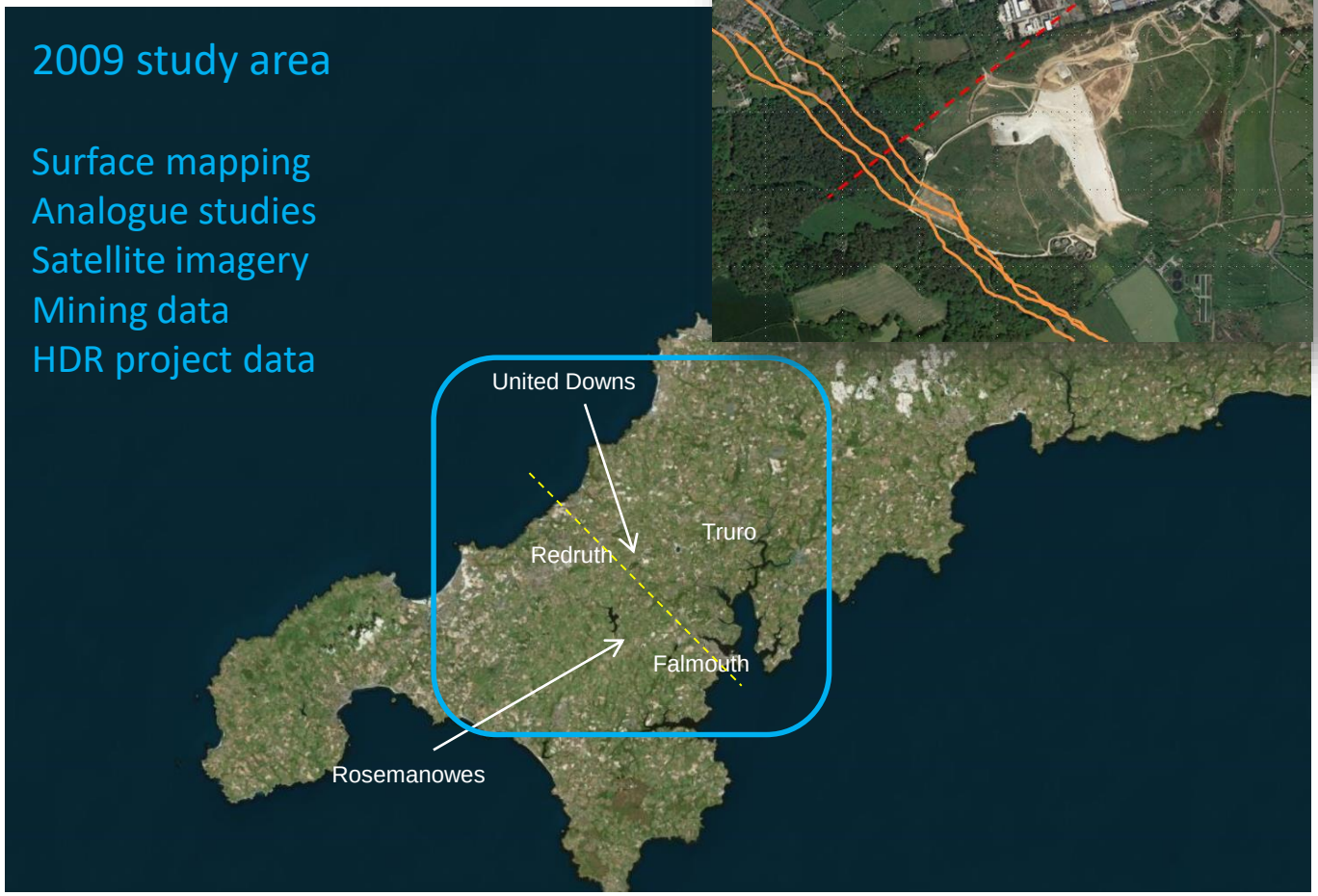


20 to 80 l/s circulation	Pumped from the production well
190°C at reservoir depth	175°C at surface
Pilot power plant	1 - 3MWe to the grid
Local use of heat?	~10,000 tonnes/year CO_2 saved

Site Selection

2009 study area

Surface mapping
Analogue studies
Satellite imagery
Mining data
HDR project data



Proximity to target fault

Proximity to granite

High heat flow

Hot springs in mines

Large enough for a big drilling rig

Good access

Sparsely populated

Likely to get planning consent

Grid connection

HAS Innova Rig

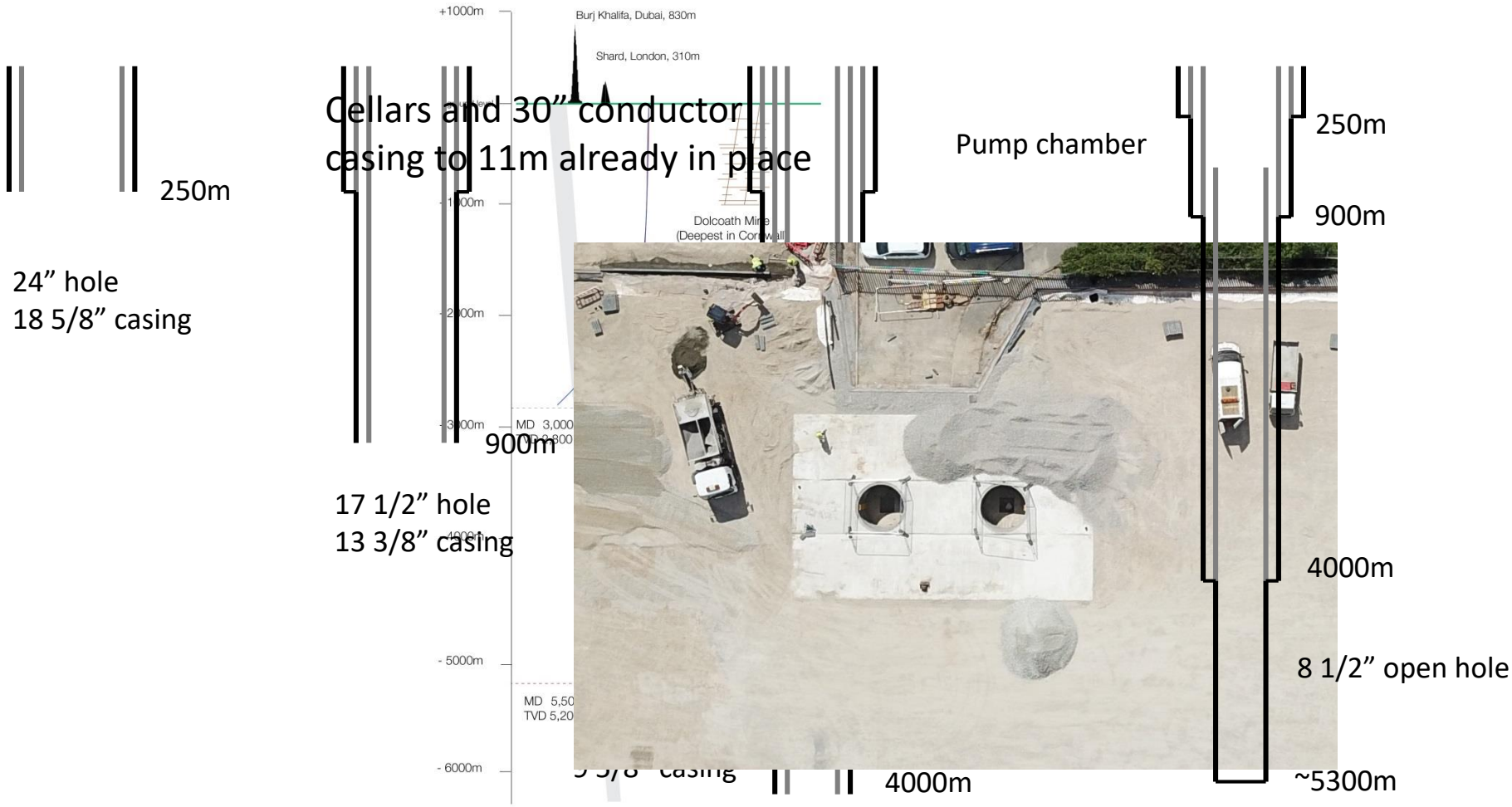
No capable rigs in the UK

Mobilised from Helsinki September - October 2018

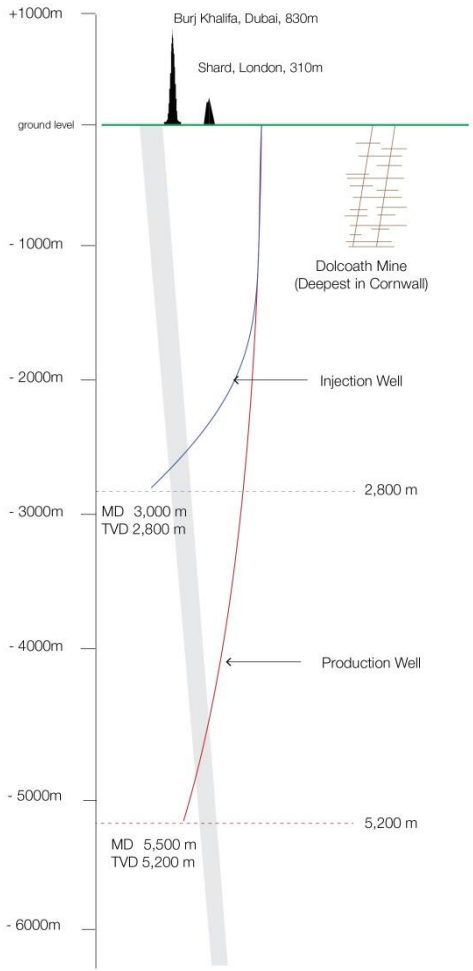
Transported by ship and then by road to Cornwall

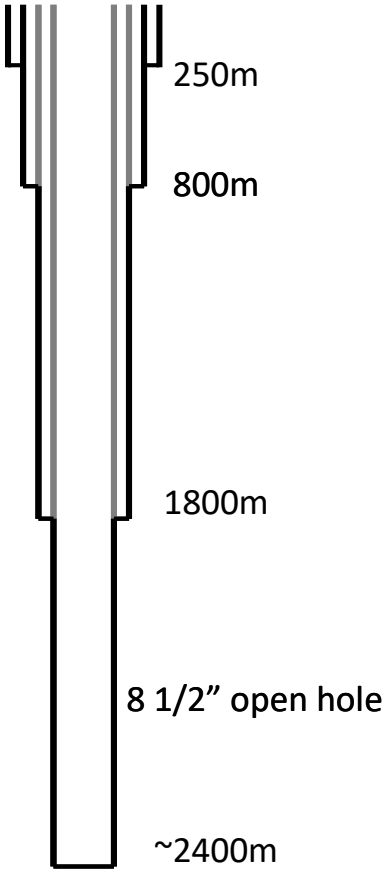
80 truck loads - small local roads and village communities

Production well ‘completion’ (steel casing)



Injection well





Noise monitoring

Continuous throughout the drilling phase

Day time and night time noise limits in our planning consent (65 and 45dB)

Automatic alerts to GEL staff

Complaints procedure

Access to sound recordings

Public access to measurements

Seismic monitoring

Engineering tool

"induced microseismic events"

Environmental monitoring

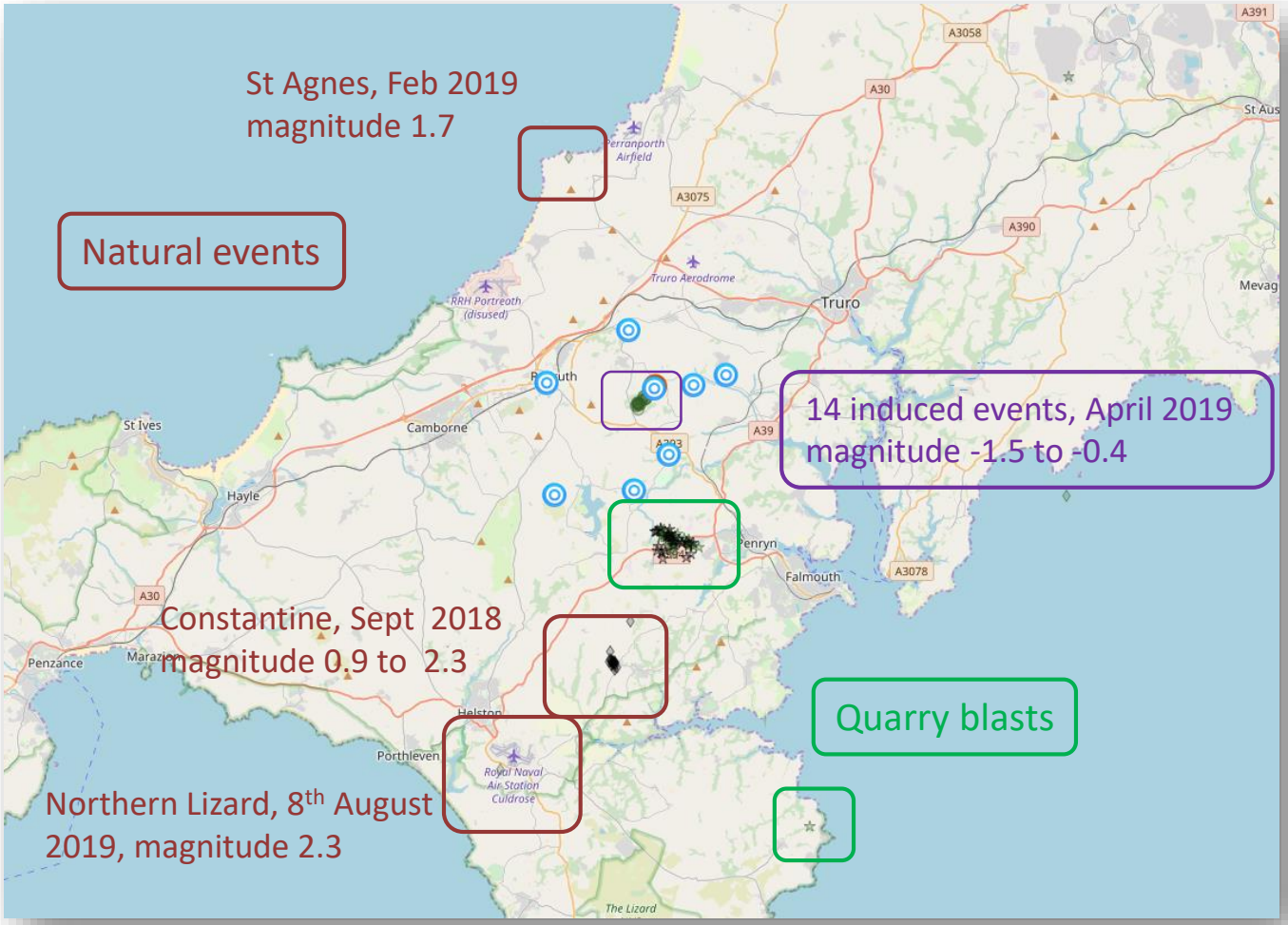
Planning condition requirement

Public concern over induced seismicity

Negative press related to Fracking

Downward migration of injected water

Background monitoring since May 2018



Community

Research

Education

Public engagement and dissemination

Business and academia

Education programme

Primary Schools

Classroom sessions, worksheets and games

Geothermal animation for Key Stage 2 pupils

Secondary Schools

STEM programme

Lesson plans and site visits

Seismicity for Schools and Raspberry Shakes

56 schools & colleges,
24 careers events
~4,000 students

Further and Higher education

University research, MSc projects, internships and work experience, site visits

'Women in STEM' and 'Girls into Geoscience' programmes

Community engagement

Public events, shows and exhibitions

Guest lectures

Open days at the site

Parish Council updates and meetings

Community Liaison Group, village community groups

Project website, information films, social media posts

Personal contact with local residents & businesses

Easy access to the project team

Support to local businesses and services

24 public events

60 group visits and
12 open days ….

2,400 visitors to the site

11 community groups

University of Plymouth research programme

"Public perception / awareness / attitudes to geothermal energy"

Clean, natural, renewable, reliable, continuous, low carbon, local source of energy with a small footprint and low impact

Drilling disturbance, noise, vibration, traffic, induced seismicity, groundwater contamination, radioactive rocks, radon gas, 'messing with the sub-surface'

Low level of geothermal knowledge and familiarity

Prominence in news and social media (often negative)

Possible amplification of risk perception

Psychological and social factors

Role of media in shaping public attitudes

Relationship with the sub-surface

Social licence to operate

UD - 1

Production Well

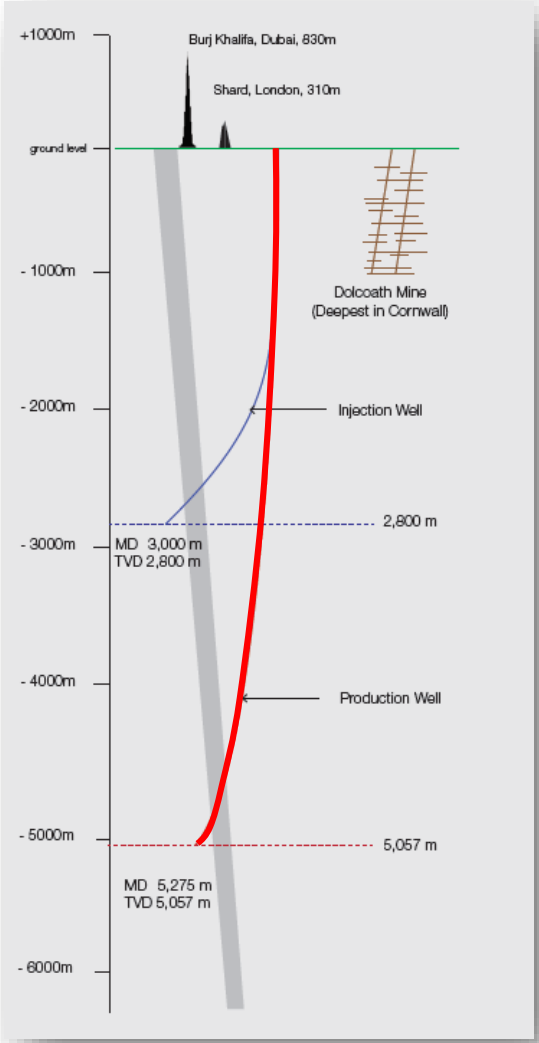
5275 m MD (measured depth)
5057 m TVD (true vertical depth)

Start date: 6th November 2018
End date : 26th April 2019

Number of days to drill: 178
Average ROP (Rate of Penetration): 3.33 m/per hour
Weight of steel used = 419 t
Weight of cement used = 358 t

Number of bits used: 28
Casing points and hole sizes:
30" casing to 11m
24" hole to 247m / 18 5/8" casing to 245m
17 ½" hole to 900m / 13 3/8" casing to 899m
12 ¼" hole to 4000m / 9 5/8" casing to 3985m
8 ½" open hole to 5275m

End of well inclination and azimuth: 33° / 236°
End of well location: 780m SW



‘Skidding’ the drilling rig

6th May 2019

UD - 2

Injection Well

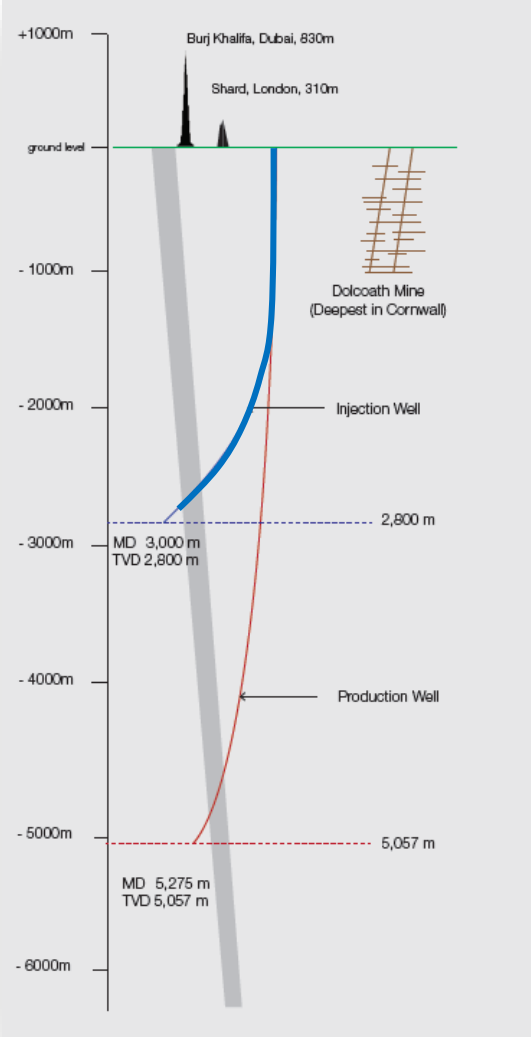
2393 m MD (measured depth)
2214 m TVD (true vertical depth)

Start date: 11th May 2019
End date : 28th June 2019

Number of days to drill: 54
Average ROP (Rate of Penetration): 4.19 m/hr
Weight of steel used = 238 t
Weight of cement used = 325 t

Number of bits used: 10
Casing points and hole sizes:
30" casing to 11m
17 ½" hole to 809m / 13 3/8" casing to 804m
12 ¼" hole to 1826m / 9 5/8" casing to 1820m
8 ½" open hole to 2393m

End of well inclination and azimuth: 40° / 233°
End of well location: 590m SW



Preliminary Results

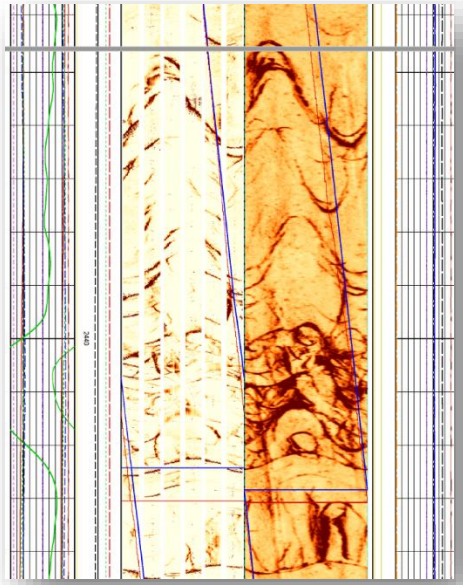
Production well completed to the planned depth

Injection well completed with 300m penetration of the target fault

Good relations with the community

Significant public interest and support

No lost time accidents



Reservoir temperature ~190°C

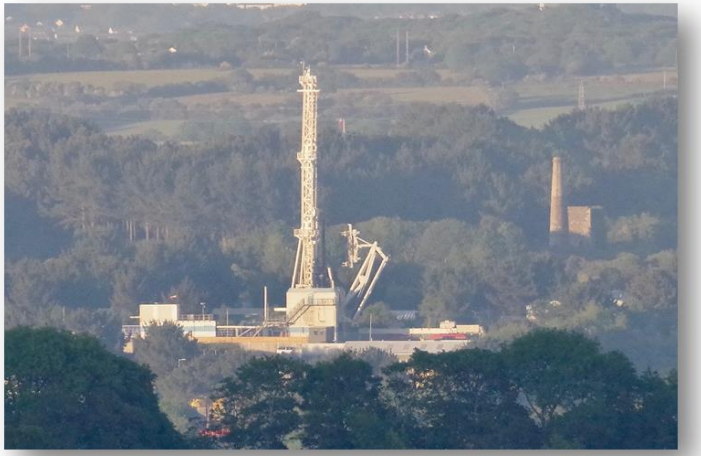
Reservoir temperature ~190°C main uncertainties:

- Temperature
- Presence & location of the fault
- Permeability in the fault

Target fault intersected at the predicted location

Reservoir permeability as-yet undetermined (but promising)

What next?



Evaluation was planned for spring & summer 2020 but now delayed

- Injection, production and circulation tests
- Establish how much energy we can produce
- Finalise the power plant design
- Prove the concept

Long term….

Develop further, larger commercial projects throughout the county

Increase the contribution of geothermal energy supply

Create a new geothermal industry

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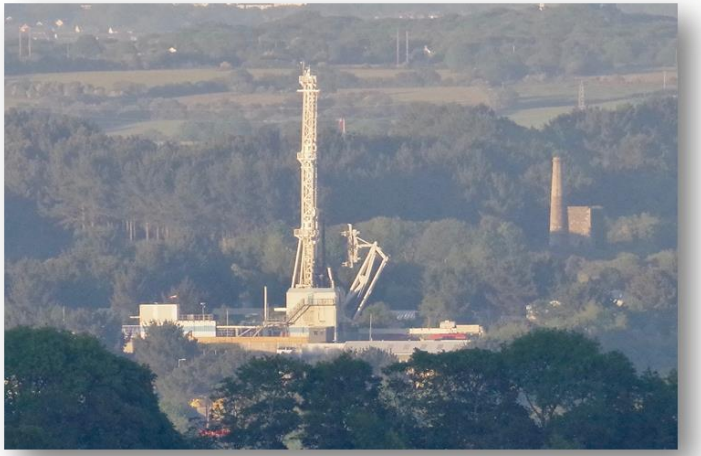

Thank you