egs|ENERGY
ENGINEERED GEOTHERMAL SYSTEMS

The Eden Deep Geothermal Plant, a first step towards the birth of new technology in Cornwall

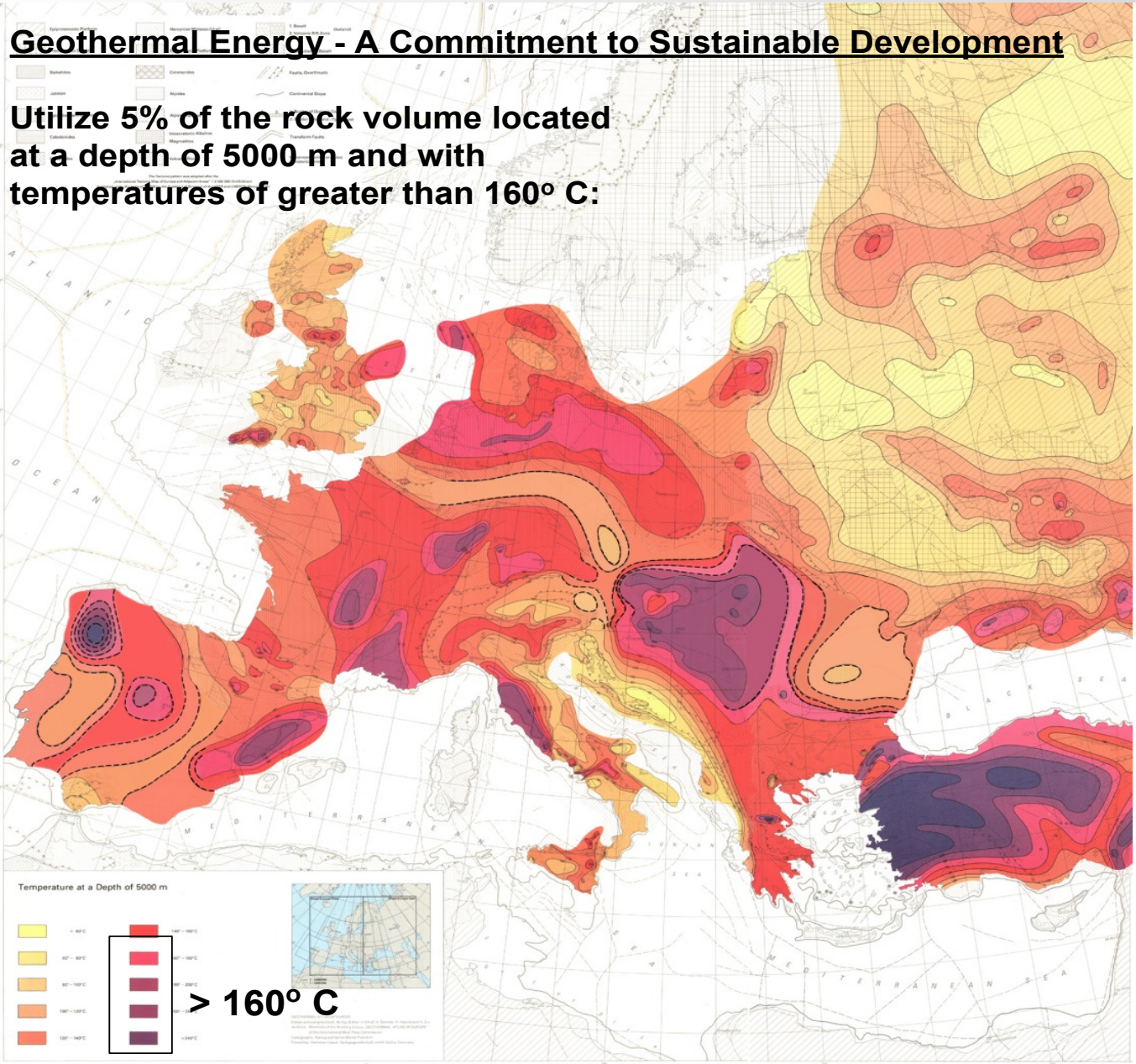
by
Roy Baria, Tony Bennett & Guy Macpherson Grant.
EGS Energy Ltd

POTENTIAL RESOURCE IN W. EUROPE

egs|ENERGY
ENGINEERED GEOTHERMAL SYSTEMS

Geothermal Energy - A Commitment to Sustainable Development

Utilize 5% of the rock volume located at a depth of 5000 m and with temperatures of greater than 160° C:



EU resources could :

*** support 130 GWe of power generation capacity**

*** generate ~900 TWh (E 45 bln/yr - market)**

*** similar to 1995 electricity generation of Europe's nuclear capacity.**

*** 35% of current EU consumption.**

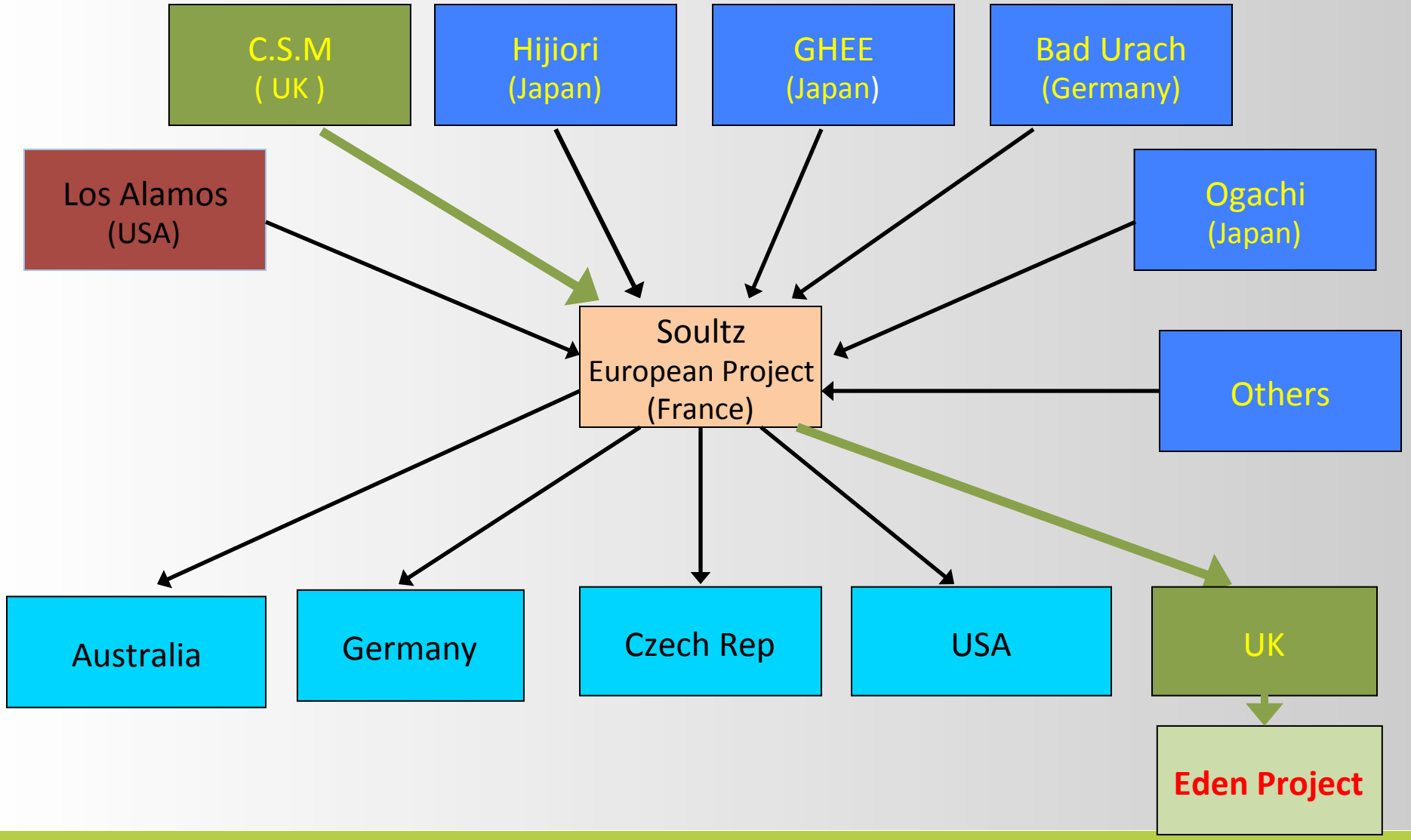
egs|ENERGY
ENGINEERED GEOTHERMAL SYSTEMS

Stored energy in the rock-mass

- If one cools 1 km^3 of granite from 200°C by 20°C to 180°C, this is equivalent to:
  - 15,000 GWh thermal; or
  - 10 MW electric for 20 years; or
  - 8,925,000 barrels of oil.

1987-2007 European Project @ Soultz, France

egs ENERGY
ENGINEERED GEOTHERMAL SYSTEMS



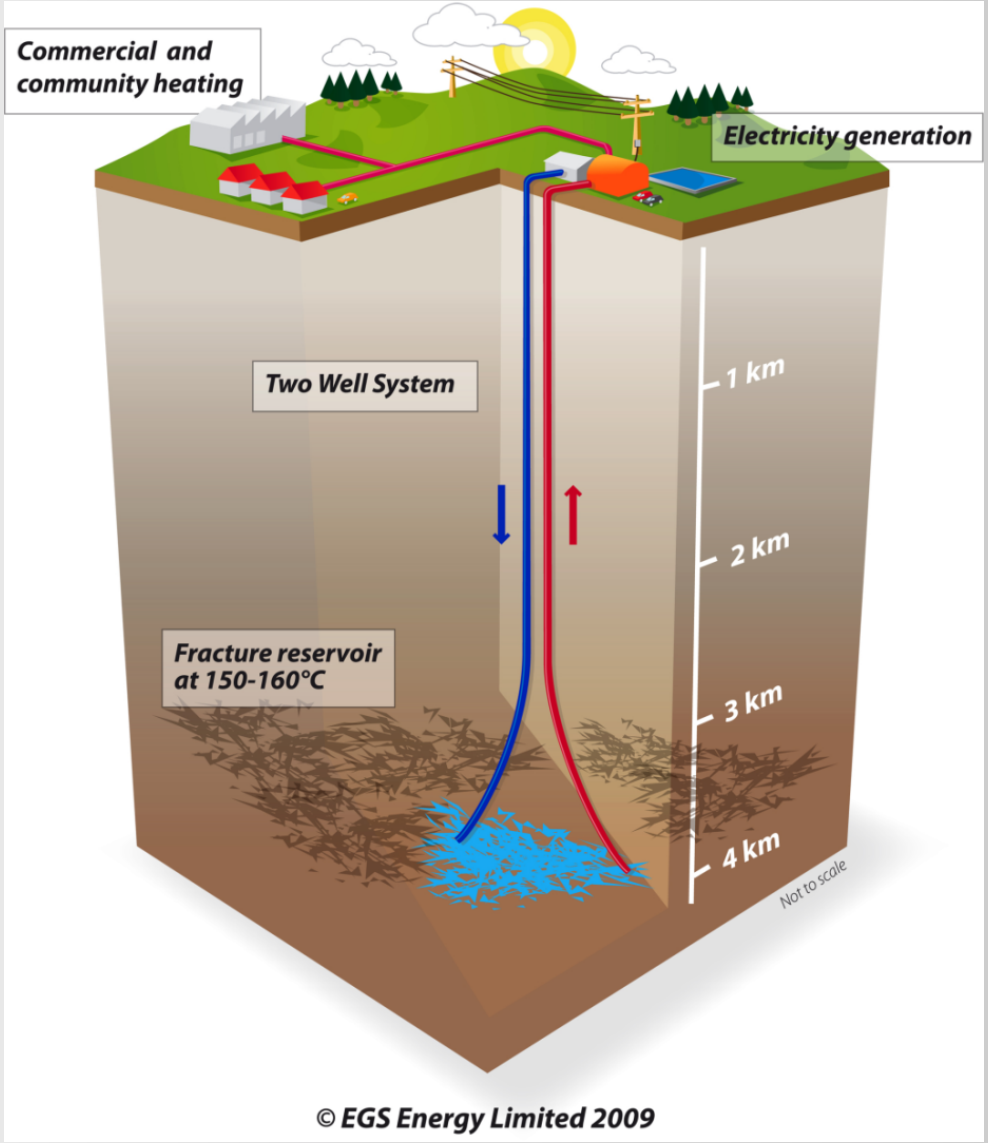
egs|ENERGY
ENGINEERED GEOTHERMAL SYSTEMS

Technology developed at the Rosemanowes project (CSM & CCC)

- Drilling technology: Select the right bits, geometry of the bits, weight on bit, no problems
- Geomechanics: Influence of stresses on fluid flow & shear failure as a dominant mechanism
- Stress measurement: In-situ stress measurement techniques
- Hydraulic investigation: Characterisation of deep geothermal reservoir; double porosity
- Tracer studies: Tracer studies to evaluate the life of the reservoir & preferential paths
- Microseismic: Monitor the development of the reservoir in real time & characterisation
- Development of specialised instrumentation: explosive tools, microseismic sensors, PTF logging sondes, downhole sparker, tracer injector, downhole samplers,
- Numerical modelling: FRIP (geomechanic code), tracer, borehole stability, directional drilling, Economics of reservoir, system life time, characteristic of shear failure, data presentation & plotting routines, etc.
- Project coordination & management: created on site with support from industry & CCC.

- Technology Exploitation: Altcom Ltd (Penzance), Geoscience (Falmouth), Calidus Engineering Ltd (Redruth), Neopartners Ltd (Falmouth), Loeb Aron & Company Ltd (London), MIL-TECH UK Ltd (Woking), EGS Energy Ltd (Penzance), Itasca (USA), Poly Dynamics (Switzerland) and others.

Schematic of the proposed first commercial EGS plant in the UK.



Birth of new technology in Cornwall

egs|ENERGY
ENGINEERED GEOTHERMAL SYSTEMS

1. Initiate and build the first deep geothermal plant in the UK at the Eden Project
2. Probable cooperation between Germany & UK as a research/commercial site.
3. Establish the site as an International Centre of Excellence on deep geothermal in conjunction with BritGeothermal, European Universities and Exeter Uni/CSM

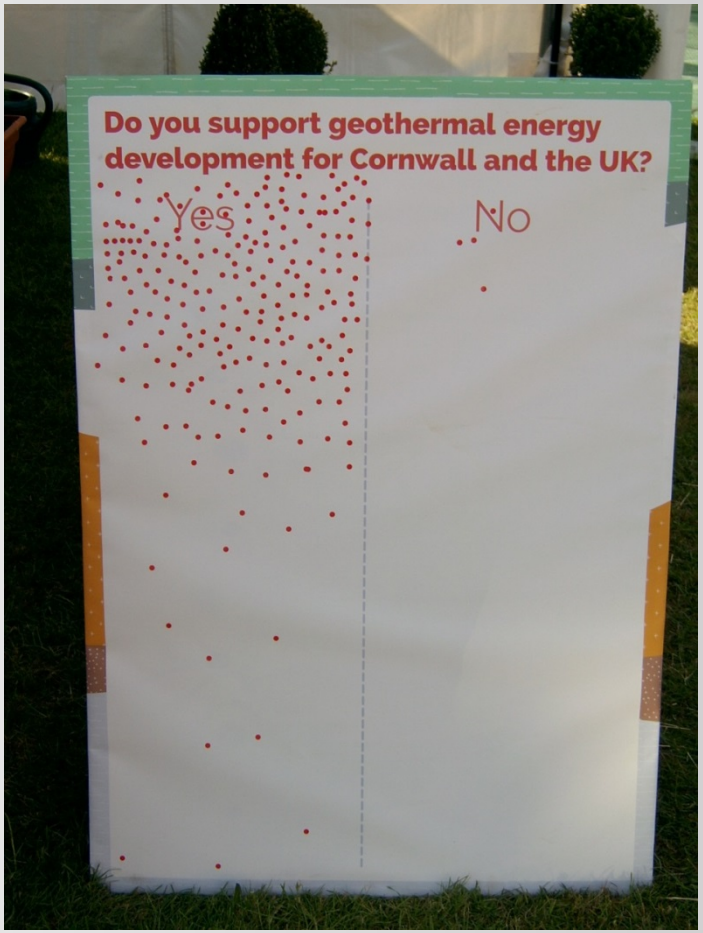
- Expand the application of deep geothermal by building 4-10MWe plants in a more systematic way to create an industry, based on electricity production & industrial heat usage.
- Establish economic criteria which encourages investment and further exploitation of deep geothermal (reduce drilling risk, planning permission, financing etc.)
- Work in conjunction with CCC and DECC to develop this & take it to much higher leve

❑ Create a successful horticultural (Dutch !)/aquaculture/recreation industry and other application of heat to provide jobs and tourist industry throughout 12 months .
❑ Further development of binary plant to improve efficiency ad heat recovery.

❖ Use the establishment of the International Centre of Excellence to create a specific course at a number of UK Universities, centred at Exeter Uni / Eden Project .
❖ Seek support from EU and others to countries to maintain this.

egs|ENERGY
ENGINEERED GEOTHERMAL SYSTEMS

PEOPLE WANT DEEP GEOTHERMAL!



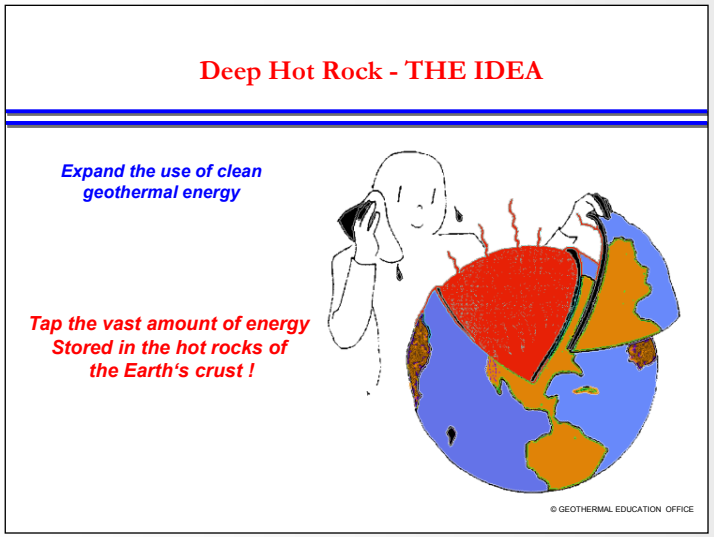
Public support for deep geothermal (Royal Cornwall Show 2013)

egs|ENERGY
ENGINEERED GEOTHERMAL SYSTEMS

The old guard: 1980 CSM TEAM AT ROSEMANOWES

egs|ENERGY
ENGINEERED GEOTHERMAL SYSTEMS

Deep Geothermal Energy (EGS)
“The potential”



egs|ENERGY
ENGINEERED GEOTHERMAL SYSTEMS

SPIN-OFFS FROM DEEP GEOTHERMAL TECHNOLOGY

1. USE OF GEOMECHANICS TO IMPORVE DEVELOPMENT AND MANAGEMENT OF OIL FIELDS
2. USE OF GEOMECHANICS TO IMPROVE DEVELOPMENT & MANAGEMENT OF TIGHT GAS FIELDS
3. USE OF EGS TECHNOLOGY TO DEVELOP BETTER EXPLOITATTION TECHNIQUE OF SHALE GAS.
4. USE DEEP GEOTHERMAL TO IMPROVE THE ECONOMICS AND ACEEPTANCE OF TAR SAND OIL
5. USE GEOMECHANICS TO IMPROVE THE DEVELOPMENT AND SUSTAINABILITY OF HYDROTHERMAL FIELDS (patent applied for).
6. USE OF GEOMECHANICS FOR CCS IN A SPECIFIC GEOLOGY