



Department
of Energy &
Climate Change

DECC: R&D AND INNOVATION

Brian Allison

DECC CCS Team

CSLF Technical Group Meeting: 28th June 2016





A Quick R&D “Canter” in 25 Slides!!

- **UK CCS R&D Programme since 2011**
- **DECC Storage Appraisal Project**
- **Muon Tomography Project**
- **C Capture Project**
- **Carbon Clean Solutions**
- **Caledonia Clean Energy Plant (CCEP) Project**
- **CCS ERA-NET (ACT)**

UK CCS R&D Programme

£220M
2011-onwards

Social Science & Environment

Capacity Development

Whole System



CO₂ Storage

CO₂ Storage & Monitoring

Storage Appraisal & Site Evaluation

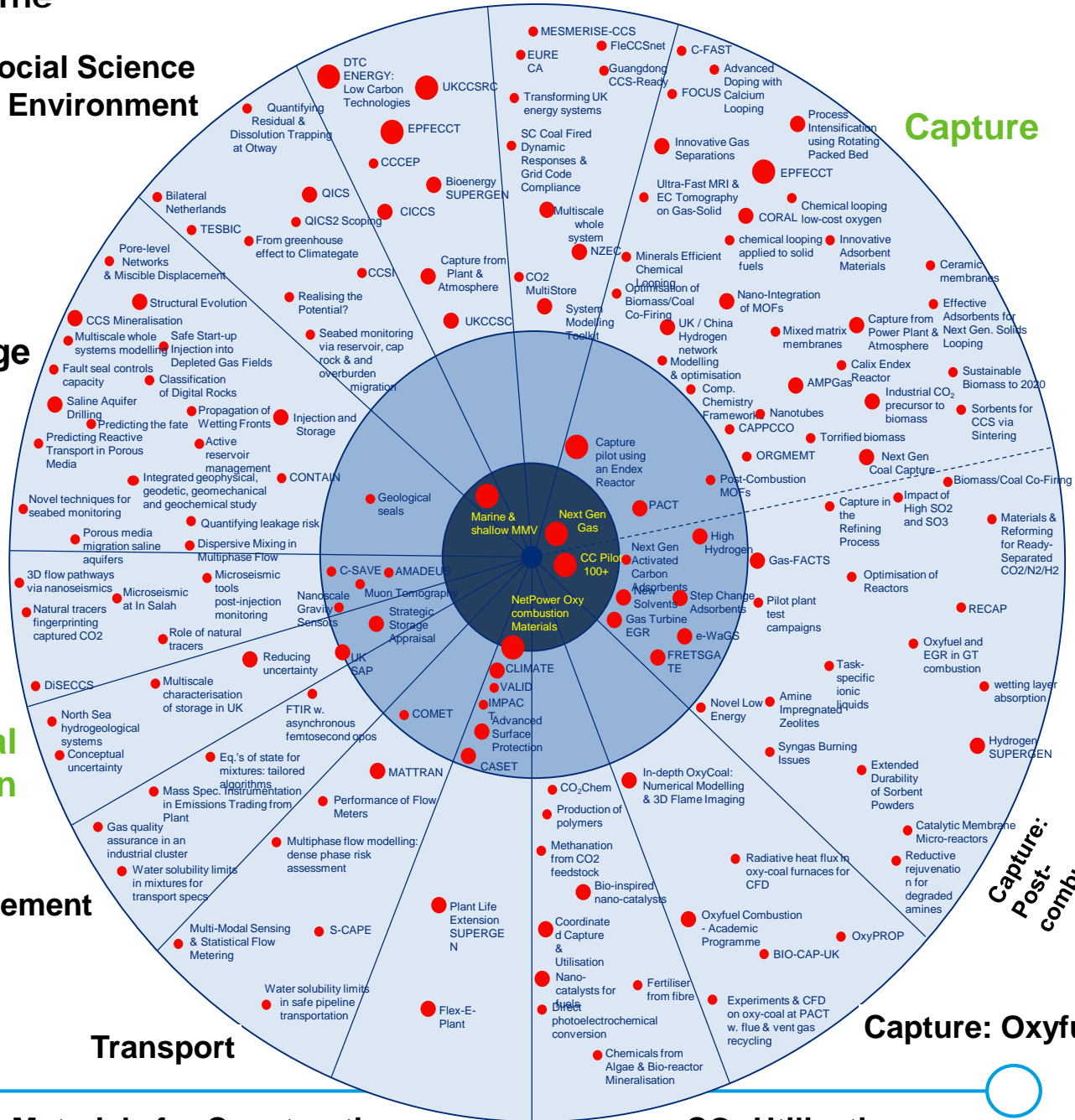
- Project with budget of <£1m
- Project with budget of £1m - £5m
- Project with budget of >£5m

Measurement

FUNDAMENTAL RESEARCH & UNDERSTANDING

COMPONENT DEVELOPMENT & APPLIED RESEARCH

PILOT SCALE



Capture

Capture: Post-combustion

Capture: Oxyfuel

Transport

Materials for Construction

CO₂ Utilisation

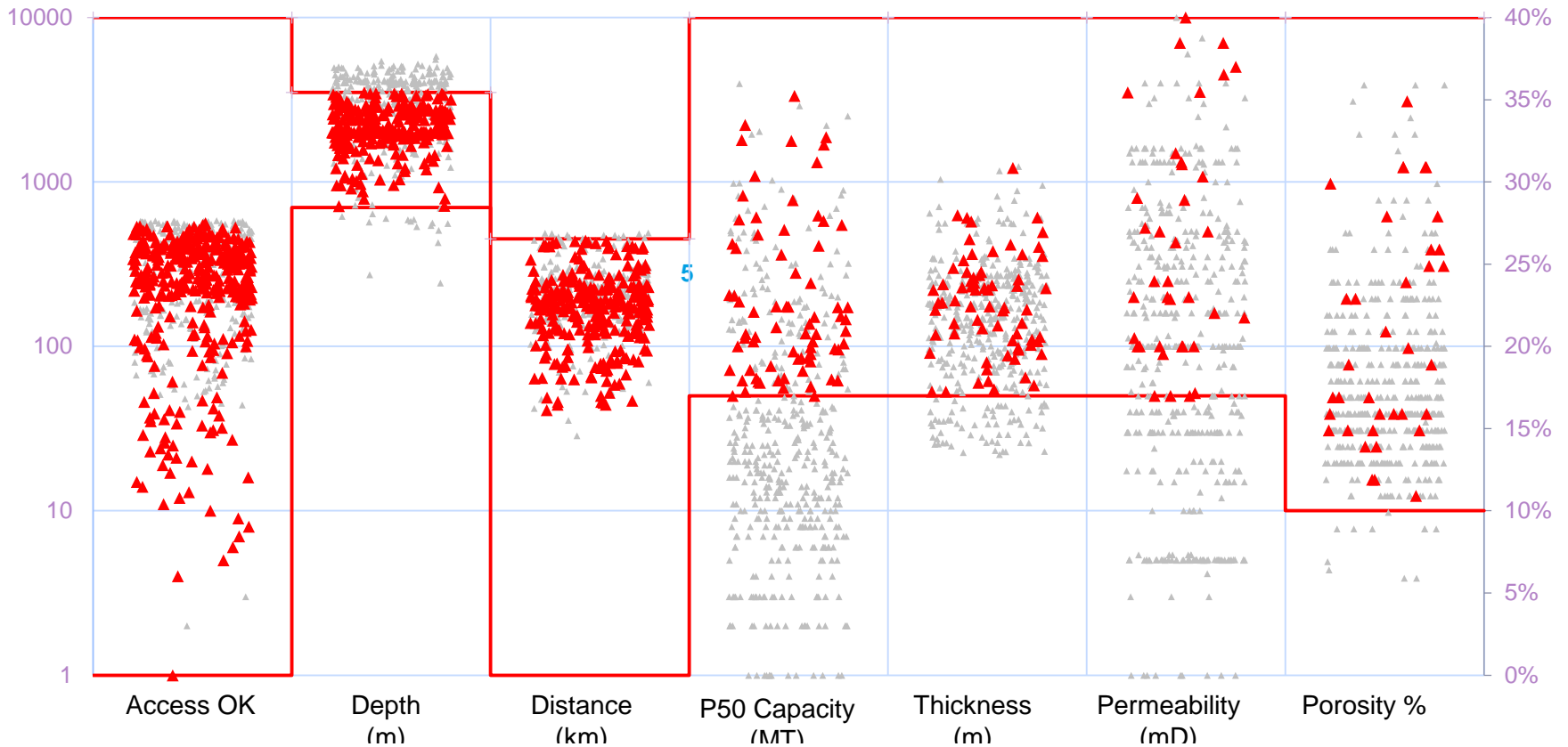


DECC CO₂ Storage Appraisal Project

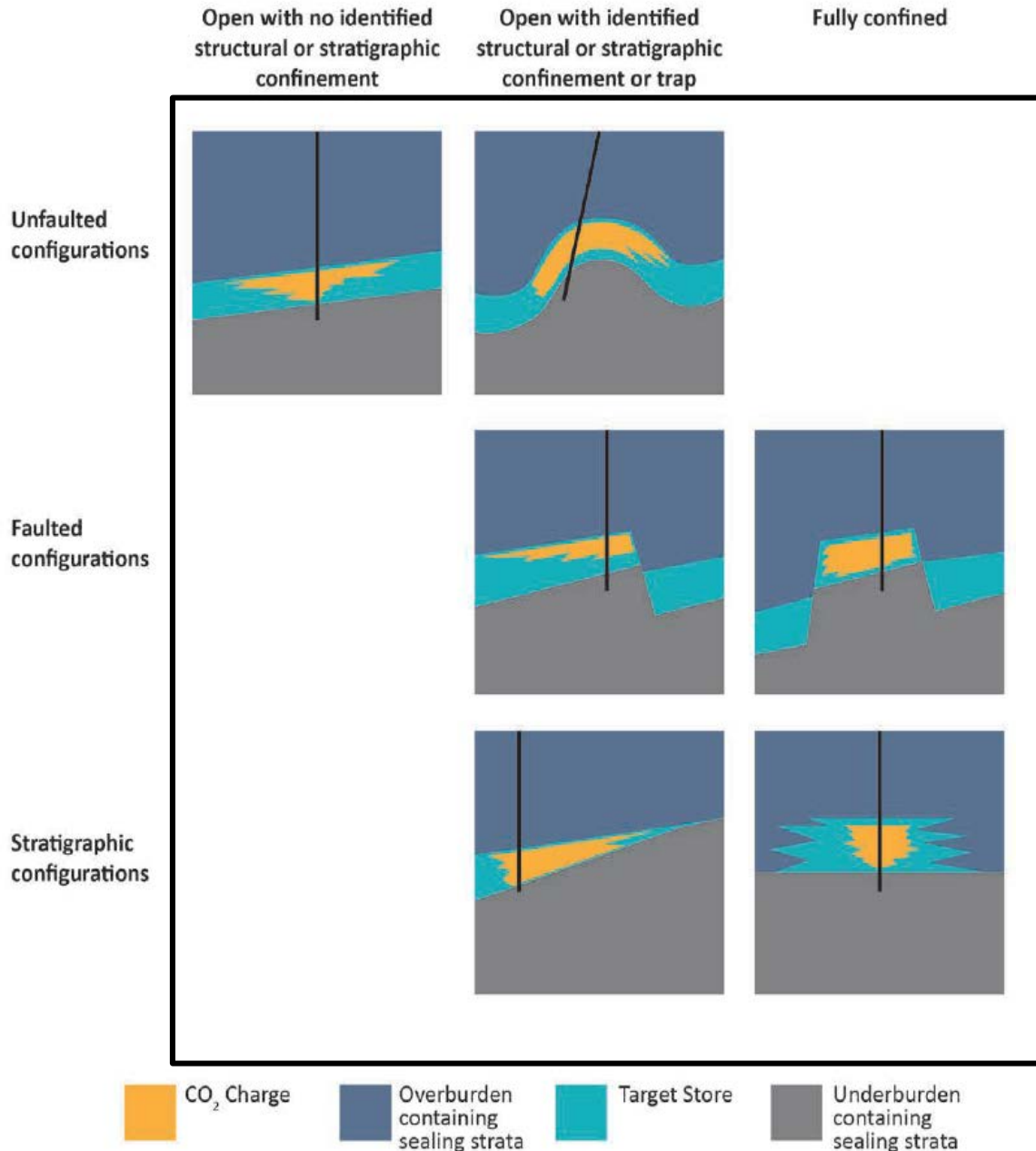
- To prove that there is a secure storage resource beyond what had already been appraised
- To alleviate most of the storage and schedule “risk” in projects - to simplify commercial discussions
- To provide encouragement that CCS is on a declining cost curve for CCS – towards £100/MWh
- To mature a portfolio of 5 stores with different development timescales and costs, servicing a broad geography and balancing risk through its diversity. DECC provided £2.5M for this project



Selection of the “Five” (579 to 37 to 20 to 5)



Types of CO2 Store



Aquifers

(88% of resource potential)

Sometimes extensively drilled: lots of data

Bigger potential

May have traps

Legacy well risk

Often lack dynamic data

More challenging to permit

Depleted Oil & Gas

(12% of resource potential)

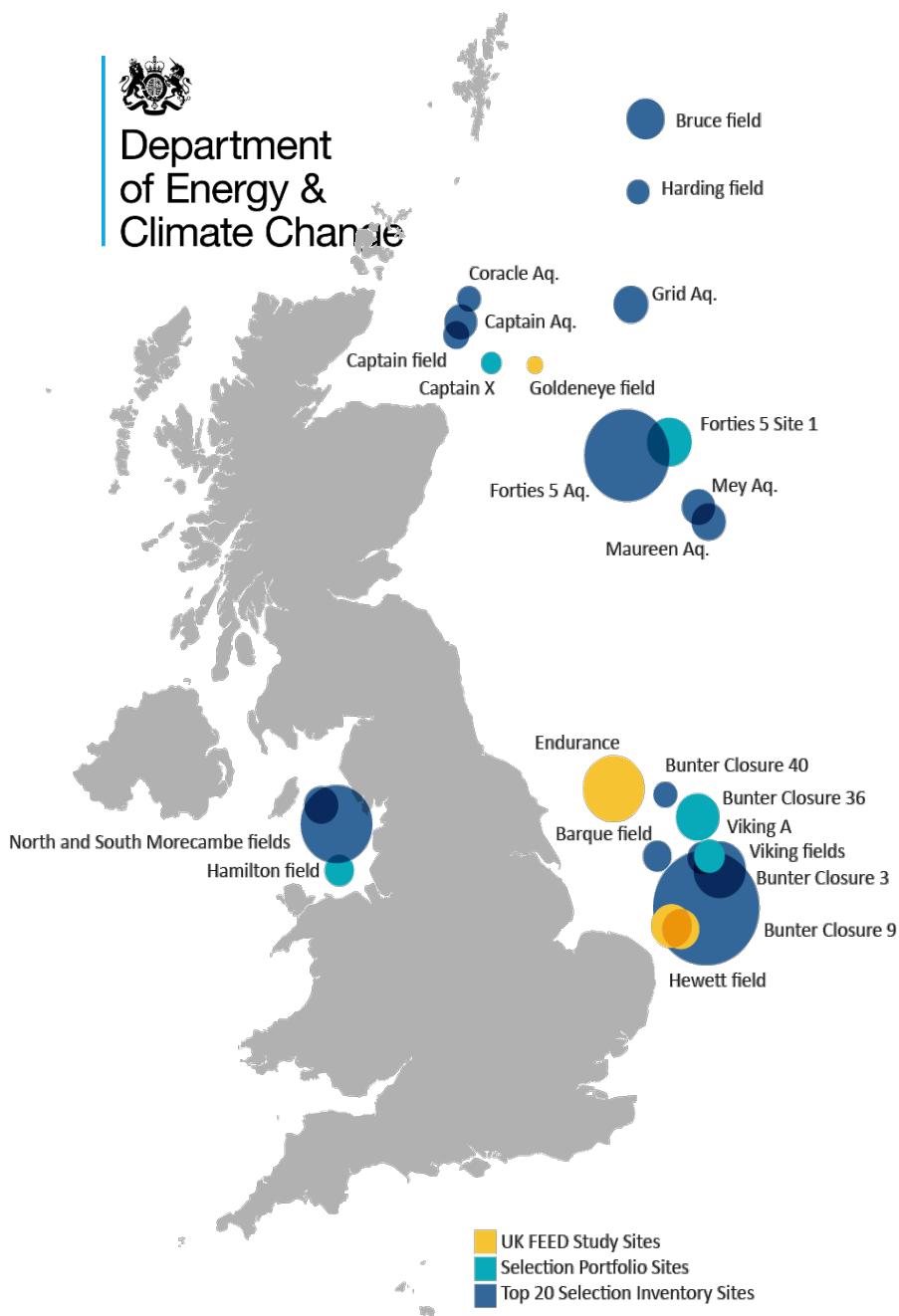
Extensively drilled – lots of data

Trap proven effective for holding oil & gas

Infrastructure re-use options

Legacy well risk

Competitive use



The portfolio of 5 sites selected are geographically and technically diverse

- Hamilton
- Captain X
- Forties 5
- Bunter Closure 36
- Viking

The UKCS is endowed with a rich and diverse national offshore CO2 storage resource, key components of which can be brought into service readiness without extensive appraisal programmes thanks to decades of petroleum exploration and development activity

Key Findings

78GT – UKCS potential
8.6GT – All qualified sites
7.1GT – Top 20 sites
1.6GT – including this study
200MT – UK FEED Studies



DECC CCS Innovation Program

Muon Tomography – a new monitoring tool for carbon storage

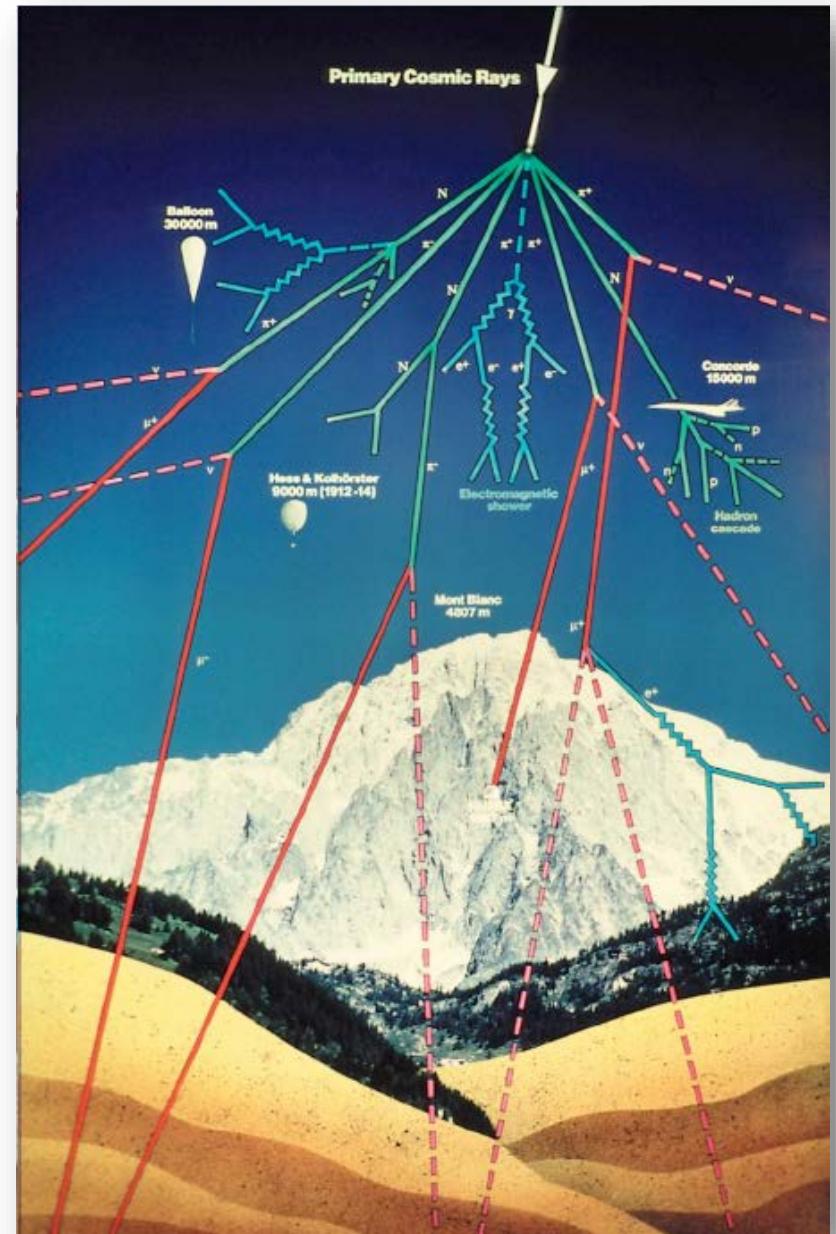
- Potential saving for UK CCS industry >£100 million per year
- Funding committed from UK CCS industry £0.95M
- Funding from **DECC £700k** (44% of project)
- Partnership – UK industry, UK academia & NASA





Cosmic Ray Muons

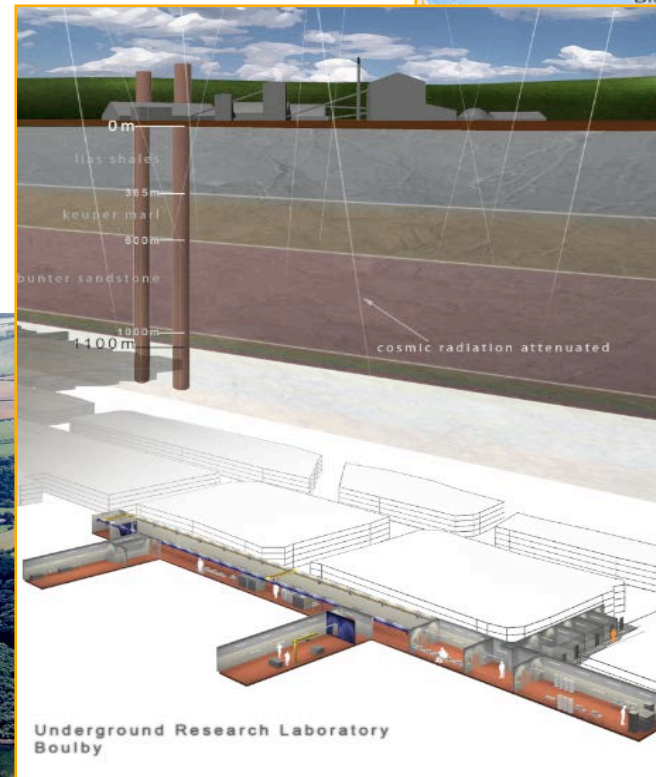
- **Charged, very penetrating particles created by cosmic radiation striking the atmosphere**
- **Loss through ionisation when travelling through matter**
- **Can be deflected when travelling through high atomic number materials**
- **Last $\sim 2\mu\text{sec}$**
- **Penetrate $\sim 2\text{km}+$ rock**





Muon Experiments at Boulby

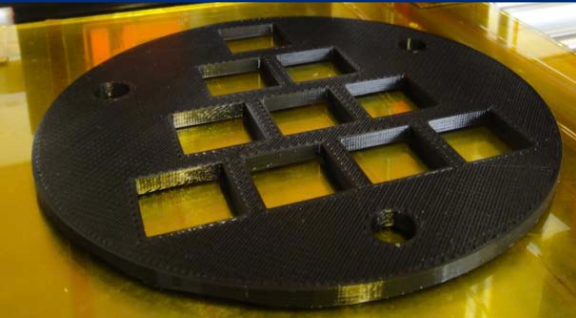
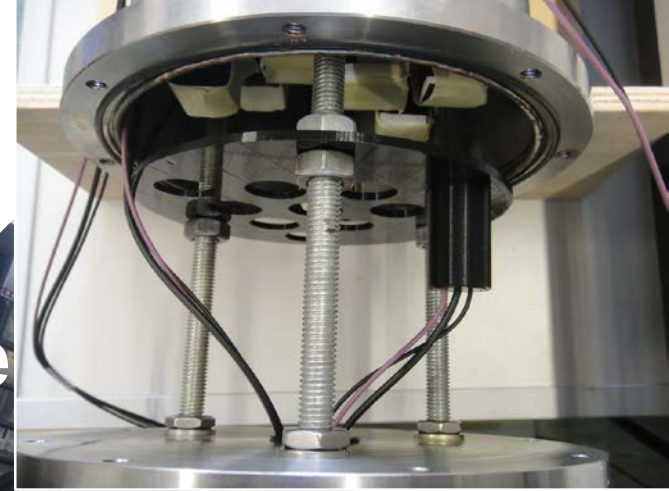
- The Boulby Science Lab is situated ~1.5km underground and is proving an invaluable testing ground
- The mine also has (now disused) tunnels running out under the North Sea





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Borehole Detector Prototype





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Boulby Installation Photos





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Energy Entrepreneurs Fund

www.c-capture.co.uk



UNIVERSITY OF LEEDS

c-capture's Demonstrator Unit



**Construction with Environ Ltd through
DECC's Energy Entrepreneurs Fund**

**Process 125 Nm³ biogas per hour (1/4
commercial size)**

Remove 1 tonne CO₂ per day

Capable of remote operation and control

**Extensive sensor deployment for process
monitoring**

**Modular design to enable scale up and
reproduction**



Another CO2 Capture Technology



www.carboncleansolutions.com



Caledonia Clean Energy Plant (CCEP) Project

- **DECC working with The Scottish Government grant funded £4.2M to Summit Power to help progress their proposed CCS Caledonia Clean Energy Plant in Grangemouth Scotland; 18 month pre-FEED R&D de-risking project**
- **Feasibility of building a new 570MW syngas CCS plant at Grangemouth in Scotland with more than 90% carbon capture**
- **The first carbon capture power plant designed to compress and deliver carbon dioxide at intermediate pressure (rather than high pressure)**
- **The funding will primarily be used to support engineering research activity through pre-FEED R&D. This will help advance the project by supporting project design and preliminary design engineering**
- **Revised IGCC poly-generation configuration to produce ~150,000 tonnes of clean H₂ for decarbonised heat and transport use, in addition to dispatchable clean electricity**
- **Industrial CCS opportunities in the industrial Grangemouth can add an additional 2 million tpa CO₂ using the same T&S infrastructure**
- **Key UK regions, Grangemouth, Teesside and Humber are working together to optimise a cost effective phased CCUS and Hydrogen production strategy**



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CCS ERA-NET (ACT)

www.act-ccs.eu



Thematic Areas of the Call

| Themes | Aim | Max (€M) |
|-------------------|--|----------|
| Chain Integration | Addressing RD&D gaps in the full CCS chain, inc CO ₂ capture, transport, & storage | up to 20 |
| Capture | Capture techniques emphasising efficiency, competitive cost and flexible operations including carbon negative solutions like Bio-CCS and other technologies. Advanced technologies aiming at a higher operational flexibility and energy efficient capture | up to 10 |
| Transport | Transport options aimed at early operations of European CCS projects. | up to 10 |
| Storage | Measurement, monitoring and verification (MMV) at relevant storage sites and the surrounding geosphere emphasising tools and methodology for a safe and cost effective CO ₂ storage in general and an increasing storage efficiency in principle | up to 10 |
| Utilisation | CO ₂ utilisation including prospective revenue streams and related business models as a vehicle to make CO ₂ capture and storage viable CCU which can substantiate comparable storage efficiency to that of geological storage and lead to reduction of the CO ₂ environmental footprint | up to 10 |
| TYPE A: | Indicative budget in total for up to 5 large projects: | 33 |
| TYPE B: | Indicative budget in total for up to 5 small projects (each < €3 million): | 8.2 |



Timeline

7th June 2016: Call text published by Norwegian Research Council

7th September 2016: Due date for proposals, Stage 1. Only short outline required

September 2016: Invitation to second stage for all application passing Stage 1

16th January 2017: Due date for Stage 2 proposals. Full proposals are required

July 2017: Evaluation of proposals completed

July 2017: Signing contracts with new projects

July 2020: Projects closing



Call Announced: 7th June 2016

Transnational call

2 Step Evaluation

Pre-proposal (5-10 pages)

Screening on national basis

Invitation to provide full proposal

External reviewers (3 experts per project)

Binding ranking list (Excellence, Impact, Quality)



Splitting the Budget

Total budget for projects: €41.2M

- ~ 80% to big projects (up to €20M)
- ~ 20% to smaller projects (< €3M)

- Each country fund own partners
- Non-ACT-members welcome to join in projects, but they will need 100% own financial contribution
- Cofund from EC can not be shared with project partners from non-ACT-members



UK – Eligible Organisations

- All UK participants in a single project must be separate legal entities
- UK companies must:
 - have been trading for at least 12 months before the closing date for applications
 - be VAT registered
 - be registered at Companies House
- Companies need to provide the following with the stage 1 application:
 - evidence they have the resources and finances to undertake the project at proposal stage
 - a copy of annual accounts for the last two years
- Companies with fewer than 5 Full Time staff cannot lead a project, unless agreed prior to application



UK - Funding Criteria

- Funding thresholds for experimental development projects are:
 - 40% for large companies
 - 50% for medium-sized companies
 - 60% for small companies
- Applicants must be able to provide evidence of private funding to cover the balance of the eligible project costs; check guidance for eligible costs
- Claims under the UK grant must be for project costs incurred in the UK



Sub-contracting

- Unless agreed otherwise:
 - Subcontracting is to be capped at a maximum of 20% of the UK budget
 - All UK grant costs, including sub-contracts, should be incurred within the UK
- Project management costs cannot be sub-contracted



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Thank You – Remember ACT

www.act-ccs.eu

Brian.Allison@DECC.gsi.gov.uk