



British
Geological Survey

NATURAL ENVIRONMENT RESEARCH COUNCIL

Gateway to the Earth

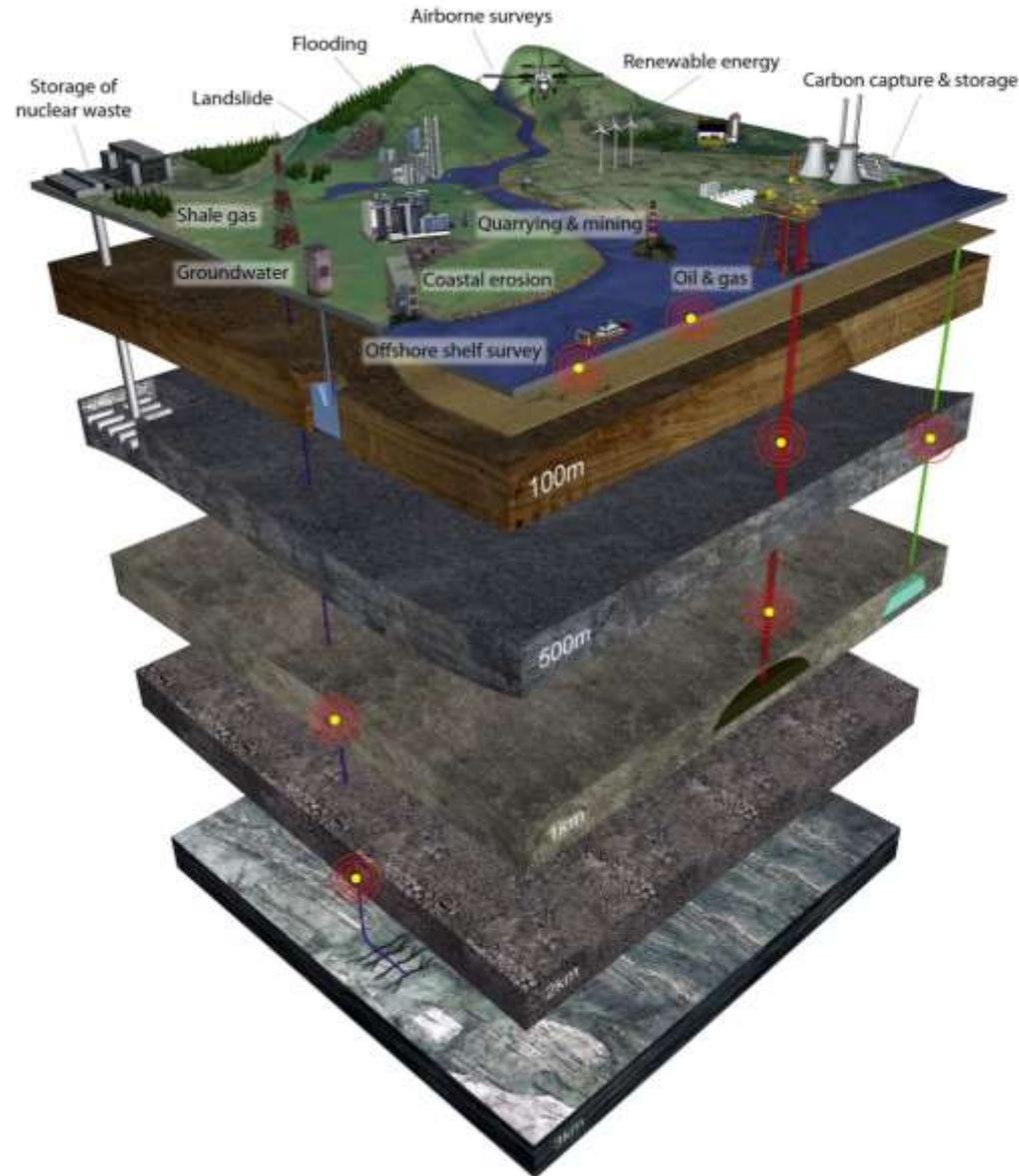
Energy Security and Innovation Observing System for the Subsurface (ESIOS) Update

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ESIOS



- Initiated by Mike Stephenson, Director of Science, BGS
- One of several proposals put to NERC for major capital investment by Government
- Supported by BIS, DECC and the Treasury
- Funding of £31M announced in December 2014 in the Chancellor's Autumn Statement
- Economic impact

NERC Strategy and links to ESIOS infrastructure development

The NERC strategy, **The Business of the Environment**, identified the importance of increasing our understanding of subsurface processes so that we can benefit from, and protect, natural resources.

ESIOS will form part of NERC's long-term strategic approach to integrated environmental observation and data science to deliver to the NERC Strategy, drive innovation and growth and bring closer a "full model of the environment", working in partnership with industry and government.



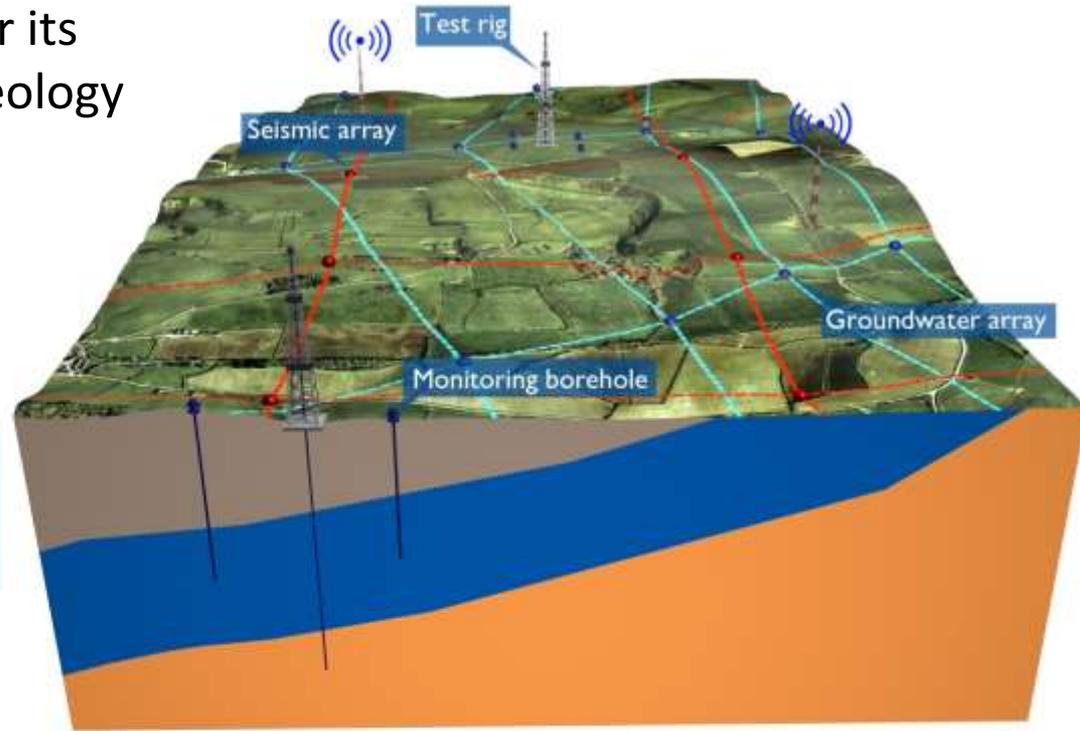
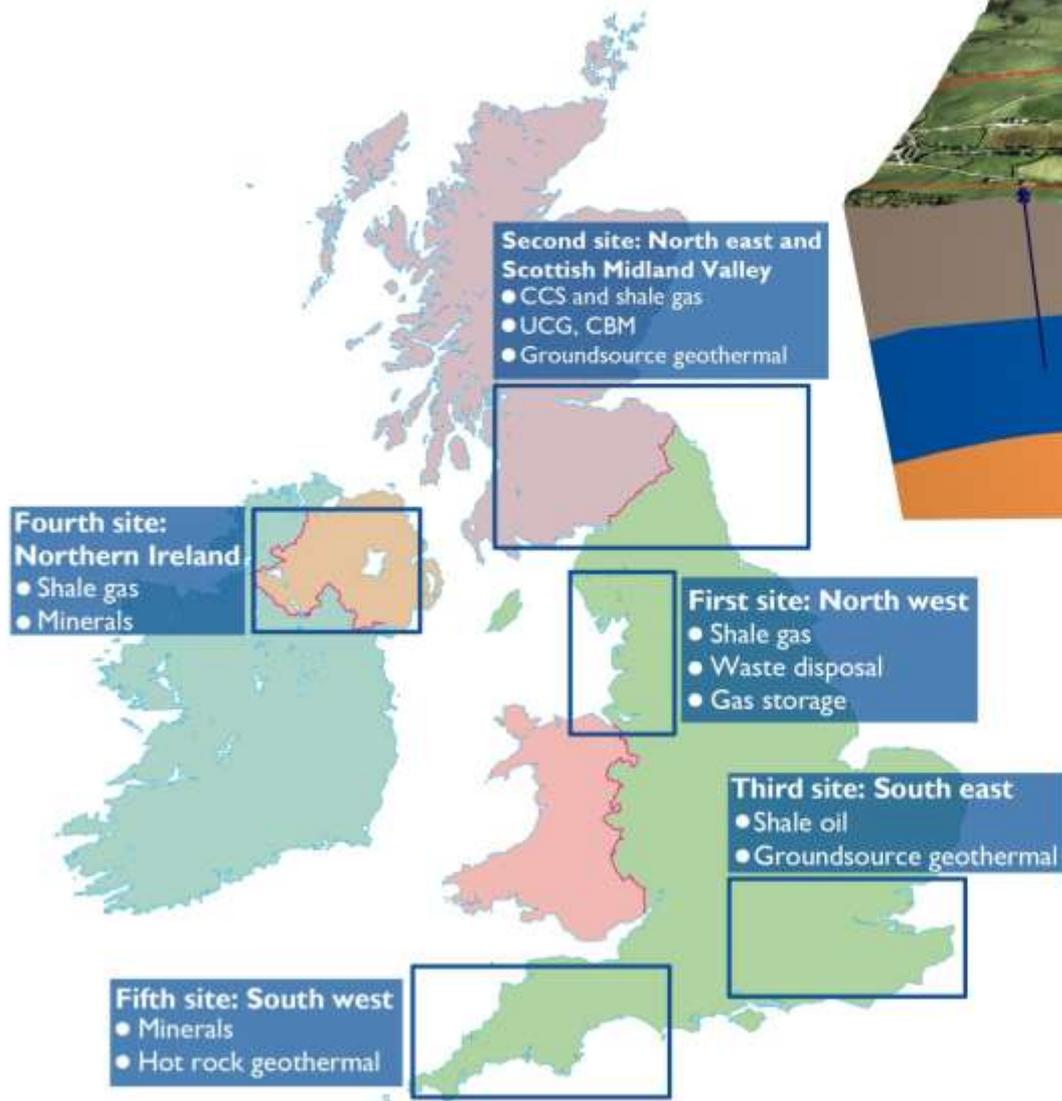
- ESIOS will establish world-leading knowledge that will be applicable to a wide range of energy technologies, both within the UK and internationally
- ESIOS will provide **national science facilities** for:
 - monitoring and observing - answering questions on how subsurface energy technologies interact with the environment.
 - increasing efficiency and environmental sustainability for established technology
 - Testing - answering questions on how to de-risk sub-surface energy supply and storage technology
 - independent scientific evidence
 - All scientific data will be available to the general public.

- The aim is to understand more about how the Earth's crust behaves in relation to subsurface energy activities, both for natural surface systems and human infrastructure..
- to improve our understanding, at a range of scales, overburden, seals, hydrocarbon reservoirs, aquifers and the critical zone - particularly in how these different zones act together and how changes interact with surface systems.
- ESIOS will add to existing methods of building knowledge: studies and modelling at laboratory scale are relatively successful and modelling methods on the scale of single permeability units have been developed. ESIOS will complement these methods at a larger scale
- Otway style facility or facilities



- Calls for projects that will define sites and research
- In the initial announcement the Chancellor referred to Thornton in Cheshire as one site
- The original proposal included several possible sites to cover different energy questions
- Final decisions for sites will depend on the science, site surveys and suitability
- The facilities will be managed by BGS

Regional-sized subsurface natural laboratories. Each region chosen for its energy challenge and subsurface geology type.



5 natural laboratories would cover a representative range of geological and energy-related conditions for UK development

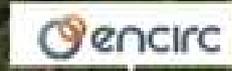
Thornton Science Park

- A new campus at an ex-Shell petrochemical research site - to pursue STEM agenda, world class research and address national skills shortages
- University of Chester Faculty of Science and Engineering
- Part of new BIS and energy industry-funded National College for Onshore Oil and Gas – centre of excellence for training future engineers
- Align students directly with engineering and scientific industries and businesses with the latest thinking, facilities and equipment
- Accommodate pre-start and high growth SMEs in environment, engineering, advanced manufacturing and automotive sectors.





Manchester Ship Canal



Childer Thornton

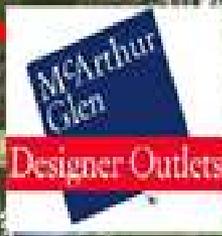
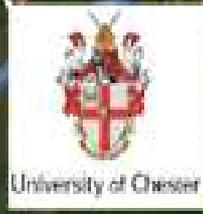
Ellesmere Port

Little Sutton

Ince

Whitby

Elton



Little Stanney

Thornton le Moors

Hapsford

Werrin

WINDLES TRAITFORD

BONHAY HILL



University of
Chester



Thornton
Science Park



Thornton will require industry support and co-funding

Appropriate geology for studying Lower Carboniferous shale and a typical northwest England seal, overburden, and critical zone sequence above

Thornton will form the hub of a network of sensors, measuring devices and instrumented boreholes and will be capable of monitoring test operations run at Thornton and the surrounding region

Shale gas licences already stretch east around the Thornton area contiguously to the north to the Lytham/Blackpool

Potential for high resolution monitoring of a hydraulic fracturing operation, and industrial value would be very high.

High level science objectives

Quantitative risk and hazard scenarios

Understanding of geologically shallow processes (less than 5 km deep)

Multi- and single phase reactive/non-reactive fluid flow and sub-surface geodynamic processes

well leakage geodynamic strain (well damage)

hydraulic fracture growth

subsidence induced seismicity

residual stress crustal change

fugitive emissions

growth & mediation of biofilms & affect on fluid flow - injection and extraction of fluids.

Role of microbiology in the carbon cycle

Intense interest to the public and regulators



- Translation of knowledge from fluid flow, geomechanics and biology into dynamic models that take account of subsurface complexity and geological variability
- Coupled models of subsurface fluid flow, geomechanics and biology with surface environmental models.
- Quantify the possibility of change to natural surface systems and to human activity.
- Improving communication between scientists and the public



A long-term coherent science plan for ESIOS will be developed between September 2015 and March 2016

This process includes an opportunity to the UK and international energy and earth science community to submit high-level science ideas to NERC

NERC are asking that ideas are at the level of concepts, for example:

- 'Investigating the geothermal potential of tight deep aquifers for geothermal heat'
- 'Investigating the causes and controls on induced seismicity in hydraulic fracturing'



These ideas will be used to:

- Develop the business case by NERC to feed into equipment for capital investment
- Define location for potential sites.
- A town hall meeting will be held on

Thursday 22 October 2015 at BGS Keyworth

to further engage with the wider scientific community and encourage participation and input to the design, concept and operability of ESIOS.

- Responses to this call for ideas will be considered by the **ESIOS Science Advisory Group.**



ESIOS Science Advisory Group

Experts to participate in the development of the science plan

Encompasses academic and technical expertise in energy and Earth science disciplines

Membership drawn from across the UK energy and Earth science community, including HEIs, ESIOS project management and end users

Develop and recommend the scientific user requirements for ESIOS to optimise science capability and capacity



Draft ESIOS Timetable		
ESIOS announced by Chancellor	December	2014
Formation of Science Advisory Group	July-August	2015
Consultation & Call for ideas	September - October	2015
Town Hall meeting	22nd October	2015
Site selection & tendering		2016
Science Programme start		2017