Paper Number: 4876

Lighting up the Subsurface

Ludden, J.N.[1]

[1] Executive Director, British Geological Survey, UK. Jludden@bgs.ac.uk

---

Global energy security throughout the next century will continue to depend on fossil fuel and nuclear, while also unlocking the potential of renewable as well as unconventional sources. Many government's industrial strategies highlight the importance of continuing support for the oil and gas and nuclear sectors, while at the same time being required to meet ambitious emissions targets. Geologist will be increasingly required to work with the subsurface both as a source of energy and also a repository for waste products (CO2, nuclear waste) and also for storing energy (compressed air, heat etc.). To facilitate this we propose the creation of infrastructure "The Energy Test Bed" to allow the subsurface to be monitored at time scales that are consistent with our use of the subsurface, to increase efficiency and environmental sustainability. An integrated multicomponent sub-surface monitoring infrastructure linked with the European Plate Observing System (EPOS) and the global energy test beds this infrastructure would underpin the following:

1. the impact of deep shale gas drilling and hydraulic fracturing on shallow groundwater and surface water, on seismic activity, and on ground stability and subsidence;
2. processes relating to the containment, confinement, and rates of solution and carbonation of subsurface stored CO2 in carbon capture and storage;
3. processes relating to the containment and confinement of subsurface nuclear and other types of waste; movement of fluids (gas, water, solutes);
4. studies on the impact of coal combustion products on the environment both from surface and subsurface operations (e.g. underground coal gasification);
5. the role of biological mediation in the subsurface in shallow to deep environments;
6. Ground deformation and induced seismicity associated with enhanced geothermal systems in hot-rock-dry-rock environments.
7. The possibility of supercritical geothermal in high geothermal gradient environments
8. Subsurface storage of potential energy (compressed air, water) and heat

In the UK and worldwide we need would develop a unique package of monitoring capability where monitoring at the surface and in the critical zone will be coupled with deep borehole monitoring of variables such as pressure, temperature, heat flow, seismicity, tilting, strain accumulation, fluid chemistry, pH and biological properties. Monitoring will also include satellite and remote sensed data such as InSAR (Interferometric synthetic aperture radar) and gravity, electrical, spectral and magnetic data. As geologists we will be in a position to reassure the public that we are able to use the subsurface and the infrastructure that underpins this will make us better at monitoring and managing these new and continuing activities safely and sustainably. Industry would benefit in being able to access state-of–the–art monitoring data to maximise efficiency of extraction and subsurface management, as well as maximising environmental sustainability.

BGS energy test bed http://www.bgs.ac.uk/research/energy/shaleGas/esios.htm, Energy Security and Innovation Observing System for the Subsurface (ESIOS).

European Plate Observing System http://www.epos-eu.org/

British Geological Survey http://www.bgs.ac.uk/home.html