



The Use of the Geological Underground – Developing the Knowledge Base on Socioeconomic, Environmental and Health Impacts

The European Environment Agency (EEA) and its Scientific Committee co-organised a seminar on “Use of the Geological Underground” at *focusTerra* at the Swiss Federal Institute of Technology (ETH Zurich) in summer 2015. This note summarises the scientific advice arising from that seminar and seeks to contribute to the emerging agenda for developing the knowledge base on long-term sustainable uses of the geological underground and its governance.

The Increasing Importance of the Geological Underground

Public concern around hydraulic fracturing (“fracking”) in shale gas basins, as well as in relation to underground coal gasification and coal bed methane, has raised considerable societal and political debate in Europe. This focuses on balancing geological, environment, and human health concerns alongside socioeconomic interests. The EEA seminar highlighted that fracking is only one of several potential uses of the geological underground and focused on how to address competing uses.

While various countries employ different definitions for the underground or subsurface, seminar participants addressed that part of the Earth and its contents (for example mineral resources such as ores, industrial minerals, raw building materials, oil, coal, natural gas, groundwater or geothermal energy) separated from the atmosphere and surface waters by the Earth’s surface. The seminar also addressed the offshore underground.

A range of sometimes competing uses of the underground were considered, including extraction of finite resources (e.g. oil and gas – conventional and unconventional – or coal), extraction of renewable resources (e.g. drinking water or geothermal energy), storage (e.g. nuclear waste or captured CO₂) or as a space for transport infrastructure or even buildings at lower depth ranges. These are underground services, the value of which is sometimes poorly understood and rarely assessed, including benefits and trade-offs inherent to different use choices. Even when these issues are assessed, adequate rules, methods and approaches to take them seriously into account may be missing.

Socioeconomic, Environmental and Health Impacts

Increased discussion around socioeconomic impacts of underground use in Europe has been driven in part by perceived economic benefits of shale gas exploitation in the USA. More broadly, however, EuroGeoSurveys estimate that around 250,000 workers in the EU are already employed in industries that rely on mineral products as raw materials. These socioeconomic considerations need to be balanced against other impacts of underground use such as direct disturbance, seismic activity and subsidence, impacts on water, soil, air, landscapes and habitats.

The EEA and its Scientific Committee also addressed the latest state of knowledge on occupational health and environmental health related to underground use. Many of these issues are the cause of public concern, posing an obstacle to societal acceptance for the various possible uses of the underground. The often long-time horizons involved increase the complexity and uncertainty, as does the fact that reliable data are patchy. Credible independent research, authoritative interpretation and clear communication are needed.

Bringing Explicit Consideration of the Underground into EU Strategic Frameworks

The European Union's **7th Environment Action Programme** (7th EAP) sets out a vision of where the Union wants to be by 2050:

In 2050, we live well, within the planet's ecological limits. Our prosperity and healthy environment stem from an innovative, circular economy where nothing is wasted and where natural resources are managed sustainably, and biodiversity is protected, valued and restored in ways that enhance our society's resilience. Our low-carbon growth has long been decoupled from resource use, setting the pace for a safe and sustainable global society.

The underground is not explicitly addressed in the 7th EAP, which does not address the integration of surface and sub-surface resources. To give one specific example, the relationship between soil and the geological underground would require further consideration.

In seeking to ensure that Europe has secure and affordable energy while achieving its decarbonisation objectives, the **European Energy Union** will have profound implications for the use of the underground in Europe, but to date these have not been explicitly addressed.

The seminar similarly emphasised that the underground does not stop at the shoreline. The offshore underground is a significant resource that should be integrated in the long-term strategy to support sustainable growth in the marine and maritime sectors (**Blue Growth**), not least given the location of the majority of the EU hydrocarbon reserve.

Applying the Principles of the EU Treaty

European environment policy is built on the principles of precaution, prevention and rectifying pollution at source, and on the 'polluter pays' principle. The integrated application of these principles in the context of the underground requires further examination. The precautionary principle in particular brings opportunities for broader societal engagement, provides a platform for more integrated risk governance and debate on questions such as the strength of evidence for action, the burden of proof and the trade-offs that society is willing to make against other objectives and priorities. This is especially relevant in the further development of the emerging agenda on the use of the geological underground.

Building the Base for a Better Governance and Knowledge Framework The seminar participants specifically highlighted the following:

- There is a need to ensure more transparency on who sets the research agenda on the underground, most notably what to study in terms of environment and health

impacts.

- A more integrated knowledge base is required, specifically on:
 - Health and environmental hazards, impacts and risks (environmental impact assessment and health impact assessment) of technologies and operations (both in terms of direct and indirect exposures and problems), demanding new approaches from health and environment researchers to build towards integrated environmental and health monitoring;
 - Governance and legal aspects of regulating the underground, including how to address the mismatch between administrative and geological boundaries;
 - Economics (including internalisation of external costs);
 - Detecting weak signals and early warnings, for example through foresight techniques.
- Integrating concepts that could aid research include:
 - underground footprint (below and above surface);
 - underground services (biotic and abiotic).
- More data and better access to data on underground uses and impacts is required to support decision-making processes. This will require transparency from commercial operators and clear rules on burden of proof and responsibility.
- It is crucial to identify synergies of multiple uses (new skills, technologies, knowledge), not only potential conflicts.
- There is a need to encourage planning that takes full account of the value of the underground and the impacts of its possible multiple uses.
- If the political will is in place to move towards integrated regulation of the underground, policy silos should be addressed (e.g. more than 18 pieces of EU legislation apply in the case of hydraulic fracturing) in a way that clearly reflects the respective responsibilities of key actors.
- Resources for implementation and enforcement will be essential.
- It would be advisable to address issues of societal acceptance (while taking into account regional differences in acceptance) at all stages of research and regulation and to identify governance solutions and processes that bring stakeholders together.

Integrating a Currently Fragmented Discussion

Notwithstanding the breadth and administrative complexity of the matter, and the existing gaps in the knowledge base, the seminar concluded (i) that existing land use and regulatory planning tools in Europe do not currently provide an integrated perspective on the use, the impacts or the value of the underground; (ii) that this constitutes a significant policy, planning and regulatory gap in Europe; and (iii) that a precautionary approach should guide the development of the required integrated perspective and the closing of the governance gap. These conclusions apply both at the level of individual European countries (taking due account of responsibilities within countries) and at the European level.

The EU Treaty already provides the basis for stronger, integrated and more coherent actions for long-term sustainable uses of the geological underground and its governance.
