Could underground disposal of carbon dioxide help to reduce India's emissions?

BGS geologists have partnered with research institutes in India to explore the potential for carbon capture and storage, with an emphasis on storage.

28/01/2025

Exposures of thick Deccan Trap basalt sequences from Mahabaleshwar, India. Rocks such as these have been proposed as potential storage reservoirs for disposal of CO2 in India due to their reactive mineral components that allow for trapping of CO2 in solid mineral form. BGS © UKRI

Carbon capture and storage (CCS) includes a suite of technologies that aim to reduce atmospheric emissions associated with large industrial emission sources, such as steel works, cement plants and thermal power stations. Balancing climate targets against the increasing emissions that result from continued expansion of these core industrial sectors represents a significant challenge for growing economies such as India. Could capturing these emissions at source and disposing of the carbon dioxide (CO_2) in porous rocks deep beneath the surface be a part of the solution? The International Energy Agency clearly thinks so, as it estimates that India will require CCS on a significant scale by 2040.

BGS work in India

BGS has been working to improve understanding of the potential for CO_2 storage as part of its International Geoscience Research and Development programme. During a successful trip to India in early 2023, BGS researchers met a wide range of stakeholders from industry, academia and policy groups to discuss the prospect of CO_2 storage. Based on these discussions, we produced a brief summary of the knowledge gaps that need to be addressed to enable India to make informed decisions on CCS. These relate to the need to:

- identify and catalogue suitable geological storage locations
- ensure protection of groundwater, soil and the surface environment
- better understand baseline seismicity and potential impacts of CO_2 injection
- develop appropriate monitoring methodologies for CO_2 storage in India
- understand public attitudes towards technologies such as CCS

An improved knowledge base is required to develop appropriate policies, including details on if, where, and how much CO_2 can be securely stored in the rocks beneath India.

BGS staff visit the research facilities at the Indian Institute of Technology Bombay. From Left to Right, Prof. Vikram Vishal (Indian Institute of Technology Bombay), John Williams, Hazel Napier and Jonathan Pearce (BGS). Photograph courtesy of Prof Vikram Vishal.

A key milestone

In March 2024, Jonathan Pearce and I travelled to Mumbai to participate in an international symposium on CCS. The event was hosted by the Society of Exploration Geophysicists (SEG), the learned society dedicated to promoting the science and education of exploration geophysics. This was the first international conference specifically dedicated to exploring the role of geology in CCS to be held in India and was attended by 124 registered delegates from 15 countries. A summary and review of the event has been published.

Jonathan Pearce of BGS delivers a talk on EU initiatives and policies on CCS at the SEG Role of Geosciences in Carbon Storage Symposium. © SEG Asia Pacific.

The symposium provided an opportunity for BGS and partners to present our research, and to participate in several panel discussions and sandpit debates. As one of the co-chairs, Jonathan Pearce of BGS even had the pleasure of providing the concluding remarks!

While it may seem a little over the top to describe a single three-day symposium as a key milestone in India's CCS journey, this story will ultimately both begin and end with the country's geology. It is the disposition and properties of the rocks that will ultimately dictate the degree to which CCS can contribute to India's emissions reduction targets. Events such as these are therefore essential in providing a forum to bring the geoscience community together to share knowledge and to exchange ideas.

Political involvement

Things are also moving at a political level in India. In July 2024, the Prime Minister's Science, Technology & Innovation Advisory Council held a meeting to discuss CCS and the government of India is currently developing a strategy for its adoption. These initiatives will clearly require further support from the geoscience community. At BGS, we continue to collaborate with our partners in India to progress the science and to provide the knowledge to allow informed decision making.