Gap analysis for CCS in a shakey paradise

B.D. Field

GNS Science, Box 30368, Lower Hutt (brad.field@gns.cri.nz)

Abstract

New Zealand is commonly perceived to be a desirable place to live, with an abundance of food, water and renewable electricity. However, with the increasing effects of climate change, those same attributes which have been enjoyed by the populace can no longer be presumed to continue. Historically, climate change has usually led to social unrest and migration, and New Zealand can expect rapid growth in population, leading to a growth in demand for resources. Growth in energy demand, in particular, will be associated with drier summer periods under various emissions scenarios. These "dry years" will impact New Zealand’s ability to generate hydroelectric power in the future, which currently provides approximately 60% of the country’s electricity demand. Low lake levels in South Island hydro lakes have in recent times impacted the generation of hydro-electricity with increasing use of fossil fuels to overcome demand shortfalls. This had led to increases in emissions and a greater need for establishing CCS in New Zealand.

There are three main types of knowledge gaps that affect CCS uptake in New Zealand:

1. **Geotechnical:** New Zealand straddles an active plate margin, and this has two significant implications: background seismicity adds complexity to the recognition of induced seismicity, and the common occurrence of faults (many of which are active) necessitates more detailed and comprehensive modelling to predict plume migration and the impact of subsurface pressure changes. Some additional issues include reactive reservoir mineralogies and rapid facies changes, though aspects of these are recorded from oil/gas field studies. The prediction of existing pressure regimes and local stress fields will require additional examination, as both are variable, particularly in sediments associated with the Neogene plate boundary.

2. **Regulatory:** Industry needs certainty on regulatory controls to plan future projects, yet central government wants a strong push from industry for CCS before it will draft regulations appropriate to New Zealand’s existing laws and geology. This is a “circular gap” that is likely to continue to hamper implementation. Issues such as field abandonment (not yet encountered in New Zealand), transitional use (permissible last-phase CO₂-flooding vs storage initiation, potentially by different companies) and corrosion mitigation/long-term liability need to be addressed, whilst considering existing operator rights and local regulators’ responsibilities.

3. **Societal concerns:** Control and facilitation by regulations will need to address societal concerns in general, as well as any cultural concerns of Māori (as required under existing law). Fears (e.g., of increased seismicity or CO₂ leakage) vs ethical
considerations (reducing global emissions) and cultural concerns (balancing carbon dioxide injection into the earth vs release into the atmosphere) are partly known from earlier research but need further, wider discussion accompanied by geoscience that is accepted by all parties as impartial.

These three themes are related, as geotechnical knowledge can inform opinion, but a social licence to operate depends also on acceptable regulatory control, and such control must not unreasonably burden storage companies. The likely speeds at which the themes are addressed will depend partly on the impacts of climate change on New Zealand (dry years, and population/energy demand growth) and partly on carbon prices/emissions penalties vs security of affordable energy supply.

New Zealand faces the challenge of harnessing energy resources whilst making cost-effective contributions to emissions reduction. CCS should be geologically feasible in New Zealand as there is an abundance of pore space at suitable depths, and there are proven commercial hydrocarbon accumulations. The challenge is to ease the regulatory pathway and optimise monitoring and verification techniques that are acceptable to industry, regulators, and society in a coordinated and timely way.

Planning should address potentially conflicting uses of underground pore space (e.g., natural gas, compressed air, and CO₂ storage). The lead-in time for greenfield underground storage of CO₂ is typically 10 to 20 years, so the country needs to be preparing now for a future with CCS.