Proposal for a Regulatory Regime for Carbon Capture, Utilisation, and Storage in New Zealand

Independent Review and Submission

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1. Aim

Review the New Zealand Ministry of Business, Innovation & Employment Proposals for a Regulatory Regime for Carbon Capture, Utilisation and Storage consultation documents:

- Proposals for a Regulatory Regime for Carbon Capture, Utilisation and Storage Consultation document June 2024 (1)
- Regulatory Impact Statement: Policies for Carbon Capture, Utilisation and Storage June 2024 (2)
- Background Information on Carbon Capture, Utilisation and Storage July 2024 (3)
- Climate Implications of Policy Assessment: Disclosure Sheet (4)

Provide responses to the 27 consultation questions.

2. New Zealand's Government's position on CCUS

1. *Do you agree that the government should establish an enabling regime for CCUS? Please provide any further information to support your answer.*

Yes, New Zealand needs as many tools as possible to reduce CO_2e emissions.

However, the scope of the proposed CCUS regime is too narrowly focused on natural gas. The scope should be significantly expanded to cover all CCUS opportunities in NZ for today, and in the medium term. This provides increased optionality for industry seeking to decarbonise and provides regulatory certainty for future applications/technologies which are under development.

Today's opportunities for CCUS include natural gas (NG), coal, and geothermal. Coal is not covered by the proposed regime.

- Facilitating CCUS for NG would provide a decarbonisation tool to North Island industry. CCUS infrastructure would most likely be focused in Taranaki where the majority of large point sources are concentrated.
- The proposed regime does not provide a tool to decarbonise coal users where fuel switching to NG is not suitable. Coal is an important source of energy, providing ≈8.5% of NZ's total energy demand (46 PJ of the 543 PJ in 2022 (5)). Coal use has reduced by ≈45% since 2002, mainly because of less demand from electricity generation. However, coal use for industry, steel, and cogeneration has remained relatively stable from 2002 to the present. Although it is preferable to phase coal out, for some industries it may be more practical to develop solutions for coal to undertake CCUS. Expanding CCUS to include coal provides optionality to industry.
- Geothermal opportunities extend beyond the capture of fugitive emissions at power stations. When coupled with forestry there are opportunities for geothermal energy to created net negative carbon sink situations (11), displace current hard-to-abate industries such as aviation fuel production, or create new emissions-free feedstocks to replace existing horticultural and agricultural practices. The current regime does not adequately enable these opportunities, particularly in terms of accounting for the lifecycles of carbon in the various processes.

Medium term opportunities for CCUS include bioenergy (BECCUS) which is not covered by the proposed CCUS regime. Direct air capture (DAC) is a rapidly developing technology which should be enabled by an NZ CCUS regime.

- New Zealand has an abundance of plantation forestry and a climate well suited to growing biomass which could be used as bioenergy. NZ's approach towards bioenergy should follow the example of Nordic countries and the UK. The UK Drax power plant is a coal power plant converted to firewood pellets (6). Without CCUS firing wood pellets produces carbon neutral power. Adding CCUS creates a significant carbon negative emissions sink for power generation. Enabling BECCUS would allow carbon neutral and/or carbon negative power generation at Huntly Power Station preserving its ability to act as a back-up to intermittent renewable electricity generation. With sufficient technology leveraging and deployment of woody biomass resources this could extend to homegrown production of fuels such as diesel, petrol and aviation fuels to displace imports and significantly reduce lifecycle emissions.
- There are also underutilised waste sources which could be converted to bioenergy in NZ. Biogas production through anaerobic digestion of cow manure/bedding is one such example, in Denmark 40% of the NG supplied to the grid is from biogas production (7). This method allows decarbonisation of end users using existing assets. Denmark has another great example where straw as an agricultural waste material is gathered and combusted to generate heat and power (8). Use of bioenergy decarbonises the end user, while maintaining existing assets, addition of BECCUS creates a significant carbon negative emissions sink for power generation, chemicals, steel production, etc. It also provides a source of carbon for sustainable chemicals and fuels.
- Direct air capture (DAC) removes CO_2 from air using liquid absorption and/or solid adsorption. Following capture, the CO_2 is desorbed, purified, compressed, transported, and sequestered in a geological storage site. DAC and sequestration permanently remove CO_2 from the atmosphere. The existing DAC processes are technically complex and have a high CO_2 abatement cost (6). As a simpler and lower cost DAC method, biochar can be used as a solid material for CCUS. CO_2 is first absorbed into forestry, biomass is sustainably harvested, thermochemically converted, and then sequestered on farmland, forestry, abandoned mines, etc. Denmark has seen the enormous potential of biochar to assist with reduction of its agricultural emissions (10), the CCUS regime should be updated to allow use of biochar and similar products. This provides agriculture and industry with low-cost options for decarbonisation.

2. *Do you agree with our objectives for the enabling regime for CCUS? Please provide any further information to support your answer.*

   Yes, but the scope of the proposed regime is too narrow and should be expanded (see response to question 1). Bioenergy with CCUS should be prioritised as it can provide home grown energy sources, it is low cost, and it can improve overall energy security. Bioenergy coupled with CCUS provides invaluable carbon negative emissions sinks. New Zealand is in a fortunate position to be a fast follower for BECCUS, reviewing and learning from the development of BECCUS economies in the Nordic countries will allow development of a derisked NZ approach.

3. Treatment under the Emissions trading Scheme (ETS)

3. *Should the ETS be modified to account for the emissions reductions achieved using CCS? If so, how do you think it should be modified?*

   Yes, the proposed approach where a ETS participant can subtract emissions captured and stored or receive New Zealand emissions units (NZU) is a good approach. However, consideration should be given to weighting the subtracted emissions or NZUs received based

on the CCUS application. CCUS with fossil fuels only prevents emissions from being emitted, whereas CCUS with bioenergy creates a carbon negative emissions sink. BECCUS is infinitely more valuable and should not be treated equally to fossil fuels. A 2x weighting for subtracted emissions or NZUs could be provided for BECCUS over 20 years to incentivise development and recognise the difference. After 20 years BECCUS could be reduced to 1x and the ability to claim NZUs from fossil fuels be stopped.

The approach for horticulture also needs to be considered where a crop consumes carbon dioxide and then is consumed by humans or animals. This activity is also a valuable and potentially sizable way of reducing direct emissions to the atmosphere. For example, if a geothermal plant collects and directs its emissions to enhance the production of food in a greenhouse, this should be credited (according to a proven factor related to embodied carbon in the crop and growing environment) with the reduction of emissions to the atmosphere.

4. *Do you agree that all CCS activities should be eligible to receive recognition for the emissions captured and stored? If not, why not?*
   Yes, see response to question 3.
5. *Do you think there should be a separate non-ETS mechanism for providing economic incentives for CCS? If so, what would this mechanism be?*
   No, too complex. A CCUS fund collected as a small tax on CO_2 sequestered could be used to fund the Government's ongoing CCUS activities. A portion of the tax revenue should also be returned to incentivise research and development of new techniques and commercial deployment of promising technologies in the NZ context.

4. Monitoring regime for CCS activities

6. *In your opinion, which overseas standards for monitoring, verification and reporting of CCUS-related information should New Zealand adopt?*
   The Australian approach as it appears to be more stringent than the EU or Canadian approaches. The Australian approach also includes certification of the proposed CCUS operator through a licensing scheme. This is essential and should prevent reckless operators or those without financial standing.
7. *Is there any other information that CCS project operators should be required to verify and report? Please reference the relevant overseas standards where applicable.*
   Yes, detailed review of the overseas standards is required.
8. *What methods should be used to quantify CO2 removal and storage in CCUS projects?*
   Use lifecycle analysis, and then require independent certification through ISCC or similar. Set out and make public (to the extent not commercially sensitive) the analysis for certain processes to serve as benchmarks across similar processes and these accounting bases can be subject to continual improvement over time.
9. *Are additional mechanisms required to ensure compliance with monitoring requirements?*
   Likely, but a detailed review of the overseas standards is required. An audit and compliance regime similar to that of the current ETS may be sufficient. This would need to allow operators to tap into sufficient expertise from independent auditors that can compare with lifecycle analysis around the world while establishing appropriate lifecycle accounting treatment.
10. *What level of transparency and information sharing is required?*
    High degree of transparency. Permitting should be publicly notified with permit applications, hearings, and issued permits made public. Additionally, annual CCS operator compliance monitoring reports, and accounting methods, etc. should also be made public.

11. *Do you consider there should a minimum threshold for monitoring requirements so that small-scale pilot CCS operators would not have to comply with them? If so, what should be the threshold?*

    Yes, based on the size (or risk classification) of the CCS scheme operators should be classified as insignificant, minor and major. The stringency of the CCS permitting, and monitoring would then increase with CCS scheme size (or risk). Based on the severity of a major leak, assuming 20-year operation, thresholds could be:

    - Insignificant 0 to 1,000 tonne per year CO_2 sequestered (tpy),
    - Minor 1,000 to 100,000 tpy, and
    - Major >100,000 tpy.

12. *Should a monitoring regime extend to CCU activity?*

    Yes, it is important to prevent double counting in CCU. Monitoring could be achieved through use of greenhouse gas lifecycle analysis, with independent certification through ISCC or similar.

5. Liability for CO_2 storage sites

13. *Do you agree the proposed approach on liability for CO2 storage sites aligns with other comparable countries (like Australia)? If not, why not and how should it be changed?*

    Yes, although it should be strengthened. The Government is the only entity, based on longevity, which could hold long-term liability for a CCS storage site. However, there are several concerns which should be addressed to manage the liability and reduce the risk of a significant incident which NZ is left to clean-up.

    - The CCS scheme closure must act in perpetuity, not just within the period when the CCS operator owns the liability. If the Government is to inherit the monitoring and liability for a CCS site, the Government should consider being a mandatory partner in the CCS project. This provides complete transparency to ensure corners aren't cut during the CCS scheme development, design, operation, and closure.
    - Management of an abandoned reservoir requires skill sets more common to the oil and gas industry and is likely outside the core competency of the Government.
    - Post closure the ongoing scheme cost could be extensive. A CCUS fund collected as a small tax on CO2 sequestered could be used to fund the Government's ongoing CCUS activities. There needs to be some time horizon where the Government can stop active management of the site and assume it is closed i.e. if no leakage has occurred in 50-100 years the site can be considered safe.

14. *Is the proposed allocation of liability consistent with risks and potential benefits? Are there other participants that should share liability for CCS operations?*

    See response to question 13.

15. *Should liability be the same for all storage sites if projects are approved? Or should liability differ, depending on the geological features and characteristics of an individual storage formation?*

    Liability should differ based on the unique risk of an individual CCS scheme. The risks will include geological features, and characteristics of an individual storage site. For example, if CO_2 is stored as a high-pressure gas within a reservoir this could be considered higher risk compared to CO_2 which is stored within a reservoir where it is converted to a solid via mineralisation or where the CO2 is dissolved into liquids. The potential to leak is much greater in the first scenario due to the presence of high pressure gas.

Geothermal fields undergoing active production are the subject of both naturally and human-enhanced cycles and changes over time. As a result, it is more difficult to conduct a full accounting and forecast of changes to lifecycle emissions due to the human component. Drilled geothermal reservoirs are already subject to management of well assets and, when making electricity, emissions are accounted for via the ETS. Increasingly, these emissions will be returned underground, creating new dynamics in the flow of carbon. The regulatory regime already in place regarding management of a geothermal reservoir/operation is sufficient with respect to the prevention of negative environmental outcomes from production activities. If a detrimental build-up of CO2 occurs underground this will both negatively affect production in shorter timescales than any possible geological release due to the nature of that being produced. The only exception to this would be very shallow injection (<250m) of gas-charged fluids, but again this can be managed as part of the existing consenting framework. At the closure of production there will be ample evidence for the state of the reservoir and storage risk levels should then subside as the reservoir slowly returns to its natural state.

16. *Do you consider there should a minimum threshold for CCUS operators being held responsible for liability for CO2 storage sites so that small-scale pilot CCS operators would be exempt? If so, what should be the threshold?*

    There should be no exemption. Based on their size, CCS scheme should be classified as insignificant, minor and major. The magnitude of the CCS liability would then increase with CCS scheme size. Based on the severity of a major leak, assuming 20-year operation, thresholds could be:

    - Insignificant 0 to 1,000 tonne per year CO_2 sequestered (tpy),
    - Minor 1,000 to 100,000 tpy, and
    - Major >100,000 tpy.

17. *Should the government indemnify the operator of a storage site once it has closed? If so, what should be the minimum time before the government chooses to indemnify the operator against liabilities for the CO2 storage sites?*

    Yes. It is the nature of an operating entity to plan for and end involvement at a site at some point. It is unrealistic to think the entity will be there forever. Minimum time should be 20 years. If a well-constructed monitoring scheme is in place then potential issues and risks will be identified in advance of closure and if this continues some time after closure then it will also capture new items related to disuse of the assets (e.g. well abandonments and integrity during shut-in conditions)

18. *Are additional insurance mechanisms or financial instruments required to cover potential liabilities from CO2 leakage in CCS projects?*

    A small tax per tonne of sequestered CO_2 should be collected to generate a CCUS fund which would fund the Government's permitting, monitoring, closure, and any incident response. The small cost spread across the whole industry will prevent detrimental impact to CCS economics.

19. *What measures should be implemented to monitor CCS projects for potential leakage and ensure early detection?*

    Gas detection, periodic site surveys, maintenance and inspection of process plant. Ideally, no maintenance of process plant is required and instead the CCS reservoir is sealed using a passive design which does not require maintenance. Reservoirs in seismically active zones should be avoided unless the risk can be demonstrated to be as low as reasonably practical.

    A monitoring scheme post-operation should be congruent with the operating scheme during operation where those measures (including data collection and interpretation) in place to ensure safe storage of a system while being charged with gases are also valid to monitor the

system after charging has stopped. The review frequency for data may be varied depending on what the rate of change is and the risks.

20. *Do you agree that trailing liability provisions are needed? How do you think they should be managed?*
    No, they are likely not practical.

6. Consenting and permitting for CCUS

21. *Are inconsistencies in existing legislation for consenting and permitting impacting investment?*
    Inexperience in local government permitting CCUS and long-term liability are two key permitting concerns. Lack of a viable business case for CCUS and uncertainty on the future of natural gas are two equally pressing issues.
22. *Should the permit regime for CCUS operations be set out in bespoke legislation or be part of an existing regulatory regime (such as the RMA, EEZ Act, the CMA or the Climate Change Response Act 2002)? Please give reasons for your answer.*
    As per response to question 1, the CCUS scheme should be expanded, this will likely require bespoke legislation or incorporation into the CCRA.
23. *Should CCS project proponents be required to submit evidence that proposed reinjection sites are geologically suitable for permanent storage, in order for projects to be approved? If so, what evidence should be provided to establish their suitability?*
    Yes. Modelling results based on collected well testing and/or operational data that shows the ability of the geological formation's ability to absorb gas volumes, with the predicted volume and pressure of stored gases determining the risk.
24. *Should there be separate permitting regime for CCU activity if there is no intention to store the CO2?*
    Yes, capture and use activities should be permitted under the RMA or its equivalent. The RMA should require CCU schemes to demonstrate independent certification of their proposed lifecycle analysis during permitting. Once in operation annual reporting against the LCA will confirm scheme performs as intended. CCU will also require management to ensure no double counting with CCS and to ensure the subtracted emissions or NZU are passed down the supply chain to the end user. Green CO_2 certificates, providing guarantee of origin, are likely to be need, these are to be passed on at each step of the supply chain down to the end user.

7. Carbon capture and utilisation

25. *Are there regulatory or policy barriers to investment and adoption of CCU technologies?*
    Yes, as described in the response to question 1, the current scope of the CCUS regime is too narrow and should be expanded to provide the regulatory framework to enable deployment of developing technologies. New Zealand will likely need either technology adaptions to our specific circumstances or can offer new techniques, but these require upfront support to the point of commercial demonstration. A portion of the tax revenue should be returned to incentivise research and development of new techniques and commercial deployment of promising technologies in the NZ context.
26. *What potential markets for CO2 derived products do you see as most critical in New Zealand?*
    Production of sustainable gas, liquid and solid fuels for domestic consumption.
    Production of biochar for domestic/international carbon sequestration.
    Production of biochar as a domestic/international feedstock to chemicals/fuels (via gasification).

The reuse or recycling of gases currently emitted to atmosphere from industrial point sources (e.g. geothermal, steel, concrete, process heat) to produce a product or produce, such as closed system horticulture and glasshouses.

27. *Are there any specific barriers to transportation of CO2?*

Small scale of existing infrastructure and cost to develop supply chain. Based on the distributed nature of NZ CO_2 point sources, truck and rail are likely to play much larger roles in CO_2 transport within NZ (outside of Taranaki). This will increase the transportation costs but will likely not impact the economic viability of CCUS. CCU is also likely limited by the small demand for CO_2. NZ's domestic industry requires very little CO2 compared to the overall production. Consideration should be given towards incentivising development of high value green industry in NZ i.e. bio/green methanol, ammonia-urea, fuels. Truck transport may not be reliable enough to provide certainty of supply to consumers.

8. References

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