Submission on CCUS framework

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Thank you for the opportunity to submit. I am providing comments based on my expert knowledge of ETS design and operations. I also have a strong understanding of CCS in climate change scenarios and climate policy packages. My CCS experience stems primarily from my time at the International Energy Agency, including as Head of the Environment and Climate Change Unit. Since leaving the IEA in 2018 I have continued to be involved as a reviewer of their 1.5C scenario reports.

I provide some introductory comments, then respond directly to the consultation questions from pg4 onwards.

CCS IN IEA NZE SCENARIO

CCS play an important but minor role in the IEA's energy sector NZE ("net zero energy") decarbonisation scenario. This scenario involves around 95% reduction globally in gross energy, transport, and industrial emissions by 2050, with the last 5% balanced by direct air capture and storage and bioenergy capture and storage. Importantly, there is NO use of forestry to offset fossil fuel emissions in this scenario: the "net" in "net zero" is achieved entirely with geological storage. There is also some use of CCS to avoid emissions, particularly in some industrial processes. High emissions prices drive adoption of CCS and other low-carbon technologies, rising to US$140/t in 2030 and US$250/t by 2050.

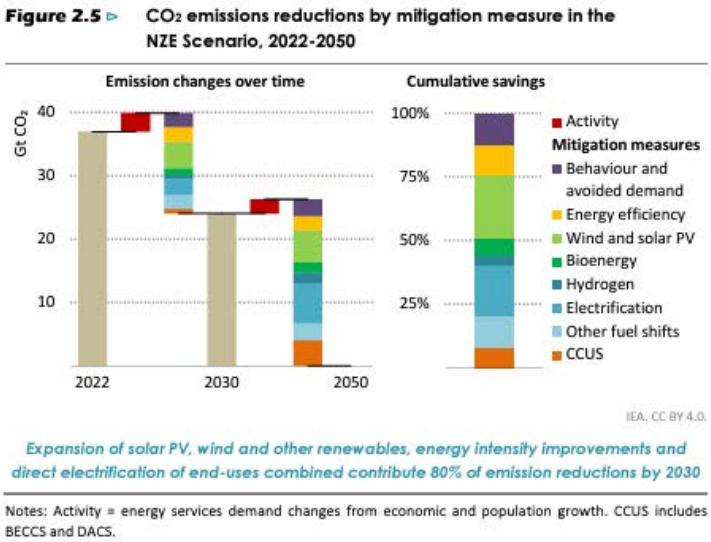

Figure 1: Figure from IEA net-zero energy scenario showing the important but minor role of CCS in energy sector decarbonisation.
https://www.iea.org/reports/net-zero-roadmap-a-global-pathway-to-keep-the-15-0c-goal-in-reach

CONSULTATION UNDERPLAYS REAL-WORLD RISK AND PERFORMANCE OF CCS

I am concerned that the consultation material seriously underplay the risk of CCS, and overstate removals in the near term.

The consultation document quotes an IPCC report saying storage is "very likely to exceed 99% over 100 years", however fails to note that the same IPCC report says this is for "appropriately selected and managed geological reservoirs". Detailed attention to site selection, and ongoing monitoring and management are very important.

The Ara Ake report "Carbon Dioxide Removal and Usage in Aotearoa New Zealand" reiterates that poor regulation gives increased risk:

> *"A 2018 report by Dr Juan Alcalde from the School of Geosciences, Kings College, University of Aberdeen, highlights the importance of regulating and monitoring subsurface reservoirs regarding their stability for storing CO2 . It states that "CO2 retention in storage reservoirs was recently assessed as 98 percent over 10,000 years for well managed reservoirs, and 78 percent for poorly regulated ones."*

I further note the comment in the interim RIS that

> *"We have not quantified the environmental risks of CO2 leakage from CO2 storage sites in New Zealand, and the potential costs of remediating these sites in case CO2 leakage from these sites in this interim RIS."*

The results quoted for estimated removals are also overstated. CCS operators typically seek to capture and store over 90% of emissions, but the draft CIPA assumes 100% storage of Kapuni and Maui East emissions.

Real-world CCS operations have encountered serious technical hurdles. Just as oil and gas exploration is uncertain and risky (e.g. evidenced by over $1B of spending in the last three years resulting in lower not higher NZ reserves), so are assessments of storage sites. There is simply no guarantee ex-ante that storage will be available at the expected level. The Gorgon project in Australia found that the intended storage site did not accept CO2 as assumed. Even the pioneering Sleipner project in Norway faced similar early hurdles in getting storage working. These significant technical challenges can delay projects, or reduce the percentage of CO2 that can be stored. Assuming 100% storage in a short timeframe is unrealistic.

The economics of CCS in New Zealand will work against early implementation in industrial applications (petrochemicals, cement). Overseas, the focus is on creating 'hubs' of industrial plant near CO2 storage sites to pool CO2 transport and storage costs. New Zealand's stand-alone dispersed industrial plants make this much more difficult. The draft CIPA and RIS assume CO2 capture starting in 2030 in petrochemicals and cement, seemingly based purely on international assessment of technology maturity, not based on New Zealand conditions. A review of the logistics of capture, transport and storage in New

Zealand – including how the necessary pipeline infrastructure could be provided – would likely show this is more difficult and costly.

IS GEOTHERMAL FUNDAMENTALLY DIFFERENT?

Overseas experience that has informed this consultation material is based on experience in industrial/power CCS, with deep geological storage. It is not at all clear to me that this experience maps well to creating a regime for ongoing monitoring, management and liability of CO2 storage in geothermal fields.

I note the Memorandum on geothermal CCS provided by Assoc. Prof. Sadiqu Zarrouk to MBIE in 2022: (https://www.mbie.govt.nz/dmsdocument/28351-memo-on-geothermal-carbon-reinjection-sadiq-zarrouk-october-2022)

> *"In New Zealand, there are currently several field injection trials by Top Energy, Eastland, Mercury Energy and Contact Energy. However, given the unfavourable reservoir rock in New Zealand (to mineralise the carbon), we can't be sure of the long-term success of these trials. We may not know the impact for several years as they will vary from field to field and require unique consideration (testing and monitoring). The fractured and non-continuous cap rock in geothermal reservoirs may allow the injected fluids to travel to the ground surface (during or after the termination of carbon injection), creating undesired CO2 fountains. Based on the above and given New Zealand's seismic active geological setting, capturing the injected CO2 and other gases in solid and binal mineral form is more desirable. This is a subject of new MBIE sponsored research to help the geothermal industry and possibly other industries through controlled mineral entrapment to reduce carbon emissions while lowering the risk of longer-term carbon storage."*

Officials may wish to consider whether to split geothermal and deep geological CCS and consider appropriate regimes for each.

RESPONSE TO CONSULTATION QUESTIONS

BACKGROUND

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

   Yes, because CCS it will be necessary to balance residual gross emissions (the last 5%) via direct air capture and storage and bioenergy capture and storage, after deep cuts are made in gross emissions.

   New Zealand climate policy is not currently aligned with that path and instead focuses on forestry offsetting. As long as the ETS is run on a purely "net" basis (with unlimited forestry) there is unlikely to be an ETS price sufficiently high for CCS to be commercially viable.

   However it is clear that below-2°C scenarios require deep gross reductions, and I believe it is inevitable that New Zealand will eventually recognise this. Setting up a CCUS regulatory framework is a helpful pre-requisite to enable the required level of ambition in future.

   CCS should not be subsidised or promoted above other technology options, but it should be an option – as long as its full costs (including long-term costs) are properly recognised.

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

   No.

   I agree with the statement that "The Government's role is not to provide financial incentives but to create a clear regulatory landscape for CCUS that provides a level playing field for reduction and removal activities." However that regulatory landscape must not be designed in a way that shifts cost and risk to the government, creating implicit subsidies. That would not be a level playing field.

   The first criteria should be clarified to reflect that the full short- and long-term costs and risks of CCS should sit with those undertaking the activities on a commercial basis. There is an implication in some sections of the RIS that the government taking over some of the commercial risk could be good because it lowers CCS prices and makes CCS more cost-competitive. That logic should be rejected: if CCS cannot compete based on its full costs, it should not be subsidised by the government. There are other energy supply options available.

   In the second objective, liability is "appropriately assigned" implies that there is a role for someone other than the commercial operator to be responsible for monitoring, management, leakage, and liability. I do not agree that should be the case. The

government taking on liability would be a subsidy for CCS that distorts competition with other energy supply options.

Energy security is an important objective generally, but not for a CCS regulatory regime. Regulations should not be skewed to favour development of one energy source over another, and the long-term integrity of the CCS regime should not be compromised because of near-term energy security concerns.

If the government wants to provide an above-market incentive for energy supply or demand investments/actions that improve New Zealand's energy security, it should do so through a separate mechanism that is open to all energy supply and demand options. Softening the CCS regulatory regime to encourage investment is an implicit subsidy and is a bad approach to energy security in a market context.

TREATMENT UNDER THE 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?**
4. **Do you agree that all CCS activities should be eligible to receive recognition for the emissions captured and stored? If not, why not?**
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?**

I broadly support the concept of a mix of subtractions and NZU crediting, however I would not make it a "choice", and further aspects should be added.

It would be more simple, logical and transparent to :

- Require participants who would have otherwise faced surrender obligations for the emissions concerned to use the "subtraction" approach (as currently for geothermal). CCS in this context is an avoided emission not a "removal", so this is the logical approach. The subtraction would clearly need be based on actual MRV'd storage each year, not an estimate of potential or expected levels.
- Award NZUs (as for "other removal activities") for those who are not emitters. This is important to encourage genuine permanent removals such as DACCS and BECCS.
- Require large industrial fossil fuel users who wish to count CCS removals to also opt in to manage their own emissions under the ETS. It would lack transparency and risk misalignment of unit supply with ETS caps if downstream fossil fuel users were to receive NZUs in relation to avoiding their own emissions. Companies that are sophisticated enough to be implementing CCS should also be expected to manage their own emissions. As one example, if Methanex wished to use CCS to avoid emissions it should also opt in to manage its own emissions under the ETS, then "subtract" captured emissions that do not occur. I do not see it as appropriate for a company like Methanex to be awarded NZUs for avoiding its own emissions.

- Reassess how the free allocation framework meshes with the CCS and removals frameworks, so that there is no double-counting, and importantly, so that companies see the same incentive to reduce emissions (e.g. switching to clean technologies) as to avoid emissions with CCS. If there is an NZU allocation or 'subtraction' allowed for CCS but no payment to e.g. move to a biomass boiler, then the CCS framework is skewing the economic incentives. This would not be a level playing field.

For clarity, in the approach I am suggesting, an ETS emitter (e.g. a geothermal field) could still participate in removals that generate NZUs in relation to other captured emissions, but would 'subtract' in terms of its own emissions obligations. For example, if a BECCS plant co-located with a geothermal plant, captured CO2 from BECCS reinjected with the geothermal fluid and permanently stored could receive NZUs.

MONITORING REGIME

6. In your opinion, which overseas standards for monitoring, verification and reporting of CCUS-related information should New Zealand adopt?
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.
8. What methods should be used to quantify CO2 removal and storage in CCUS projects?
9. Are additional mechanisms required to ensure compliance with monitoring requirements?
10. What level of transparency and information sharing is required?
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?
12. Should a monitoring regime extend to CCU activity?

I agree that a regulatory approach to monitoring and information is essential, along with an audit and compliance regime.

A critical question is for how long that obligation exists. That decision needs to be based on the required permanence of the removals, NOT be an attempt to make CCS cheaper. CO2 emissions last in the atmosphere for hundreds to thousands of years. Any removal that is used to offset those emissions needs to have the same permanence.

I would point officials to the California ETS, in which 100 year monitoring is required before field closure. A response "but there wouldn't be any CCS activity with that kind of long-term obligation" would effectively be admitting that CCS cannot compete if its full short- and long-term costs are factored in. The government should not seek to promote CCS through weak regulatory settings that shift cost and risk to taxpayers.

If there is a handover of responsibilities to the government at some point, then funding to carry out the future monitoring should be provided by the commercial operator: ongoing monitoring is part of the CCS activity from which they have profited. For comparison, foresters who receive NZUs in the ETS carry the ongoing obligations to report and maintain carbon stocks, in perpetuity – it would be inequitable for government to take over costs for one type of removals.

Again, if the government sees the need to intervene to promote energy security it could do so via a level playing field offer to all energy supply and demand options.

I also note that the MRV system may need to be different for geothermal vs oil/gas fields, given their very different physical characteristics. It is not clear to me how leakage monitoring would work in an active geothermal field.

LIABILITY

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?
14. Is the proposed allocation of liability consistent with risks and potential benefits? Are there other participants that should share liability for CCS operations?
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?
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?
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?
18. Are additional insurance mechanisms or financial instruments required to cover potential liabilities from CO2 leakage in CCS projects?
19. What measures should be implemented to monitor CCS projects for potential leakage and ensure early detection?
20. Do you agree that trailing liability provisions are needed? How do you think they should be managed?

I do not agree with the proposed approach – the government should not be taking over obligations and liabilities unless this is accompanied by financial instruments or insurance to cover the costs of ongoing monitoring, maintenance and liability for any leaks – at least for a period of 100 years as in the California ETS. Financial mechanisms should also be used to ensure that the government is not left with liabilities if a commercial operator collapses (i.e. let's avoid another Tui situation).

One illustration of the inequity of transferring liability is to compare truly permanent CCS (via rock mineralisation) with reservoir storage (where while leaks are unlikely, are possible). Truly permanent storage is significantly more expensive, but this would change if governments did not agree to take on long-term monitoring and liability responsibilities for reservoir storage. A requirement for commercial CCS operators to fund their own long-term responsibilities would reflect the true cost of their risk, and would help level the playing field with truly permanent storage.

This raises the question of "least cost". "Least cost" to whom? If costs are pushed onto future generations, or onto the environment, it may lower costs for commercial operators in the short term, at the expense of New Zealand's broader interests. As the IPPC report "Carbon Capture and Storage" put it:

> *Any discussion of long-term CO2 geological storage also involves intergenerational liability and thus justification of such activities involves an ethical dimension. Some aspects of storage security, such as leakage up abandoned wells, may be realized only over a long time frame, thus posing a risk to future generations. Assumptions on cost, discounting and the rate of technological progress can all lead to dramatically different interpretations of liability and its importance and need to be closely examined.*

If dedicated funding/insurance for ongoing monitoring, maintenance and liabilities not provided by the commercial operator at the point of handover, there is a real risk that future governments may not see this as a priority in annual government Budget rounds, and the necessary management may not occur.

I also note that the liability/responsibility system may need to be different for geothermal vs oil/gas fields, given their very different physical characteristics. It is not clear to me how long-term liabilities would work in an active geothermal field.

CONSENTING

21. Are inconsistencies in existing legislation for consenting and permitting impacting investment?
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.
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?
24. Should there be separate permitting regime for CCU activity if there is no intention to store the CO2?

My only comment on consenting is that CCS developments have been of high public interest overseas, particularly where located onshore, both for the fields themselves and for CO2 pipeline infrastructure. There will be particular public interest in assuring community safety. For this technology to have social license, communities must be given an opportunity to be part of the permitting process.

Suitability of storage sites must be demonstrated, and public safety assured. The California permitting rules are again a useful reference – these for example require modelling of a CO2 plume from any release.

CCU activities do not need to have the same requirements to show permanence of storage, but may still have local storage of CO2 or CO2 transport pipelines. These will be of high public interest and would need appropriate consenting/permitting.

CCU

25. Are there regulatory or policy barriers to investment and adoption of CCU technologies?
26. What potential markets for CO2 derived products do you see as most critical in New Zealand?
27. Are there any specific barriers to transportation of CO2?

It is not clear to me why CCU needs to be included in this consultation, as it can and is being done now. There are no ETS implications (as CO2 is still emitted), and there are no long-term issues of monitoring/liability that require a fundamentally different regulatory approach.

CCU activities should of course be subject to permitting/consenting, particularly given that local storage of CO2 will be part of the operation and there may be CO2 transport pipelines. There will be public interest in assuring community safety – for this technology to have social license communities must be given an opportunity to be part of the permitting process.