MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

COVERSHEET

Minister	Hon Simon Watts	**Portfolio**	Energy
Titles of Cabinet Papers	Enabling Carbon Capture, Utilisation and Storage Policy Approach for Carbon Capture, Utilisation and Storage	**Date to be published**	27 March 2025

List of documents that have been proactively released		
Date	**Title**	**Author**
October 2024	Enabling Carbon Capture, Utilisation and Storage	Office of the Minister for Energy
16 October 2024	Enabling Carbon Capture, Utilisation and Storage ECO-24-MIN-0223 Minute	Cabinet Office
9 October 2024	Regulatory Impact Statement: Enabling Carbon Capture and Storage	MBIE
9 October 2024	Climate Implications of Policy Assessment: Enabling Carbon Capture and Storage	MBIE
December 2024	Policy Approach for Carbon Capture, Utilisation and Storage	Office of the Minister for Energy
11 December 2024	Policy Approach for Carbon Capture, Utilisation and Storage ECO-24-MIN-0305 Minute	Cabinet Office
26 November 2024	Regulatory Impact Statement: Further decisions on an enabling framework for Carbon Capture and Storage	MBIE

Information redacted **YES**

Any information redacted in this document is redacted in accordance with MBIE's policy on Proactive Release and is labelled with the reason for redaction. This may include information that would be redacted if this information was requested under Official Information Act 1982. Where this is the case, the reasons for withholding information are listed below. Where information has been withheld, no public interest has been identified that would outweigh the reasons for withholding it.

Some information has been withheld for the reasons of Confidential advice to Government, Negotiations, and National Economy.

Regulatory Impact Statement: Enabling Carbon Capture and Storage

Coversheet

Purpose of Document	
Decision sought:	*Decisions on regulatory changes to enable carbon capture and storage*
Advising agencies:	*Ministry of Business, Innovation and Employment (MBIE) and Ministry for the Environment (MfE)*
Proposing Ministers:	*Minister for Energy, Minister of Climate Change*
Date finalised:	*9/10/2024*

Problem Definition

Carbon capture, utilisation and storage (**CCUS**) is internationally recognised as an important part of the portfolio of options to reduce net greenhouse gas emissions. It has the potential to reduce the cost of meeting New Zealand's emissions budgets and provide alternative ways of reducing carbon emissions, particularly in hard-to-abate industries. It could also contribute to New Zealand's energy security by improving the economics of gas production.

In August 2024, Cabinet agreed to a develop a clear, enabling framework for CCUS, including with a view to reducing the costs of gas production. Some aspects of CCUS are already possible and taking place under existing regulatory settings. This includes utilisation of captured carbon, and reinjection of carbon from geothermal energy generation.

However, injecting captured carbon into suitable geologic storage formations for permanent sequestration (Carbon Capture and Storage, or **CCS**) is unlikely to be deployed in New Zealand under existing regulatory settings. This is because there is no ability to reward carbon capture and injection into a geological storage site, meaning there is a lack of financial incentive to carry out these activities. If CCS were deployed, there is no mechanism to make operators liable in the event that some or all of the carbon stored subsequently leaked into the atmosphere.

Executive Summary

CCS involves the capture of carbon dioxide (**CO_2**) from large point sources (such as upstream fossil natural gas extraction and production facilities) and the injection of CO_2 into deep underground geologic formations such as depleted oil and natural gas reservoirs. It is an internationally recognised suite of technologies available to reduce net emissions.

CCS is in a very early stage of development in New Zealand but could have applications in the near to medium term in upstream oil and natural gas production, and in chemical production. These applications include both emissions reduction from these activities and improving the economics of oil and gas production.

In August 2024, Cabinet agreed to establish a clear enabling regulatory framework for Carbon Capture, Utilisation and Storage, including with a view to reducing the costs of gas

production. Some activities are already enabled, such as utilisation of captured carbon, and reinjection of Co2 from geothermal energy production.

However, under current regulatory settings, CCS activities are unlikely to be deployed in New Zealand due to the lack of a mechanism to reward geological CCS activities. Additionally, if CCS were deployed there is no current ability to make a CCS operator liable under the NZ ETS for any CO_2 leakage from a storage site. This RIS focuses on these two issues:

- The treatment of CCS under the NZ ETS; and
- Who would be liable for any emissions leakage of CO_2 from storage sites in order to provide the right incentives to mitigate the risks of leakage occurring.

Additional features of a regulatory framework for CCS will be subject to further analysis to inform subsequent Cabinet decisions.

Options to reward CCS

We have identified the following four options to reward NZ ETS participants for CCS under the NZ ETS.

- Option One: status quo (no reward)
- Option Two: NZ ETS obligation reduced to recognise CCS
- Option Three: NZUs rewarded to recognise CCS
- Option Four: recognising and rewarding CCS through a separate carbon credit scheme

Our analysis suggests that **Option Two** would be the preferred option for providing an economic incentive for the forms of CCS that are most likely to be economic in the immediate term. However, Option Three is likely to be more relevant in the future, and is in some ways superior to Option Two, especially if direct air capture technology becomes more common and achievable, and/or if non-NZ ETS participants wish to set up CCS activities.

Options to assign liability for CO_2 leakage into the atmosphere

If a business was rewarded under the ETS for undertaking CCS, it is unclear how liability would be assigned, if CO_2 were to leak from the storage formation into the atmosphere.

We have identified the following three options for the assignment of responsibility for CO_2 leakage into the atmosphere:

- Option One – The Status Quo
- Option Two – Operator initially responsible under the NZ ETS for potential CO_2 leakage, but liability will transfer to the Crown, once injection operations cease, and if conditions are met
- Option Three – Operator initially responsible under the NZ ETS for potential CO_2 leakage, but liability may transfer to the Crown, once injection operations cease, after some period, and if conditions are met

Our analysis suggests that **Option Three** would be the preferred option, since it establishes an expectation that the operator would be liable for CO_2 leakage, but also allows that liability for future CO_2 leakage *may* transfer to the Crown in future, some time after injection operations have ceased, and if conditions can be met (such as providing of evidence that permanent sequestration has been achieved). This would increase the economic

attractiveness of CCS over the status quo, whilst creating an acceptable level of fiscal risk to the Crown, to allow that the benefits of CCS may be realised.

Limitations and Constraints on Analysis

In August 2024, Cabinet agreed to the development of a clear enabling framework for carbon capture, utilisation and storage, including with a view to reducing the costs of gas production.

This RIS focuses on the treatment of CCS under the NZ ETS, and assignment of liability for any emissions leakage from CO_2 storage sites.

As CCS activities can currently be undertaken by the oil and gas industry incidental to their existing operations, and the project economics of doing so are the main barrier, the decision was taken to split decisions into:

- Initial decisions by Cabinet on high level features of the scheme, with an initial emphasis on treatment under the ETS to provide a financial incentive to undertake CCS activities, and determine liability; and
- Follow up decisions on detailed design choices for the operation of the regime, which require further policy work.

Following public consultation and MBIE's discussion with MfE and other agencies, officials consider it necessary to undertake further investigation into how the resource management framework could be adapted for approving CCS projects, in order to fully operationalise a regulatory regime for CCS activities. This is likely to include appropriate monitoring, reporting and verification (MRV) arrangements for CCS projects. This will be the subject of additional analysis and further detailed policy decisions by Cabinet.

Because policy approvals are being sought in two phases, the options analysis in this RIS assumes MRV settings are in place. This is a limitation of our analysis, as the nature of the MRV regime has not yet been decided.

Cabinet decisions to establish a regulatory framework to enable CCUS limit the scope of options considered. Other potential policy options that would directly facilitate the uptake of CCS, are not within the scope of this analysis. For example:

- government funding arrangements to subsidise investment in CCS
- mandating the use of CCS technologies in industries, such as power plants or other point sources.

The impact of the CCS policy proposals on New Zealand's emissions is uncertain, as it depends on the extent to which:

- emitting businesses choose to invest in deployment of CCS technology and are able to successfully use it to capture and store their emissions in approved geological reservoirs either from production of natural gas or from other sources.
- use of CCS activities unlocks greater gas production and the flow-on GHG emissions impact of this additional supply of gas.
- impacts on the demand and supply for NZUs, which may be caused by recognition of CCS activities under the NZ ETS (if such recognition is agreed by Cabinet).

There is also uncertainty regarding the potential impact of the CCS policy proposals on the uptake of CCS in New Zealand, and the further effect this might have on natural gas supply, and natural gas and electricity prices.[1] This uncertainty is due to:

- a lack of access to commercial information held by businesses that could be interested in investing in CCS.
- uncertainties in carbon price and other relevant factors such as how future technological developments could impact the relative costs of CCS and other methods for reducing net emissions.
- the complexity of the factors affecting electricity and natural gas prices.
- the detailed design features of the CCS regulatory regime still being developed. These features (e.g. MRV requirements for CO_2 storage sites, and how the financial liability for these sites is to be assigned) will be considered in further report back to Cabinet.

We have not quantified the environmental and financial risks associated with CO_2 leakage from CO_2 storage sites in New Zealand, as they are expected to be assessed on a case-by-case basis within the framework for granting approvals for CCS projects.

Responsible Manager(s)	
Sharon Corbett Policy Director Energy Markets Branch Ministry of Business, Innovation and Employment *9 October 2024*	**Kara Lok** Manager**,** Emissions Pricing Policy Ministry for the Environment *9 October 2404*

Quality Assurance (completed by QA panel)	
Reviewing Agency:	Ministry of Business, Innovation and Employment, Ministry for the Environment
Panel Assessment & Comment:	The Regulatory Impact Analysis (RIA) panel consisting of representatives from the Ministry of Business, Innovation and Employment and the Ministry for the Environment has reviewed the Carbon Capture and Storage Regulatory Impact Statement (RIS). The panel has determined that the RIS ***partially meets*** the quality assurance standards for regulatory impact analysis. The panel acknowledges that this RIS is part of a wider work programme and that the implementation, monitoring, evaluation and review of CCS projects will be the subject of a subsequent RIS. Nevertheless, the panel is of the opinion that:

[1] As natural gas is used for electricity generation, natural gas prices affect electricity prices to some extent, particularly when electricity demand peaks in winter months.

	• the status quo and problem definition have been clearly described and the case for regulatory intervention adequately made
	• the objectives accurately describe the outcome, although more attention could have been paid to the trade-offs between the options
	• an appropriate range of options has been identified and analysed consistently to arrive at the best option
	• the analysis could have been more thorough, for example, by:
	  ○ including a consideration of the potential for an increase in emissions
	  ○ using criteria that allowed for better differentiation between the options
	  ○ addressing issues related to Crown liability when CCS operators become insolvent
	• the consultation undertaken and the key feedback received is appropriately summarised
	reasons for undertaking limited or no consultation at this point are provided.

Section 1: Diagnosing the policy problem

What is the context behind the policy problem and how is the status quo expected to develop?

Carbon Capture and Storage (CCS) is an important technology in the global transition away from fossil fuels

CCS involves:

- the capture of carbon dioxide (**CO_2**) from large point sources (such as upstream fossil natural gas extraction and production facilities, power generation and industrial facilities), or direct capture of CO_2 from the atmosphere, and
- the injection of CO_2 into storage sites, such as depleted oil and natural gas reservoirs. This involves the injection of captured CO_2 into deep underground geological reservoirs such as deep saline formations and depleted oil and natural gas reservoirs.

There is growing international support for CCS. Both the IPCC[2] and the IEA[3] consider it could play an important role in reducing global emissions.

CCS is at an early stage of development in New Zealand

CCS is in its very early stages of development in New Zealand. The only operational use of CCS in New Zealand has been geothermal reinjection of CO_2, including at the Top Energy

2 https://www.ipcc.ch/report/sixth-assessment-report-cycle/

3 https://www.oecd-ilibrary.org/energy/energy-technology-perspectives-2020-special-report-on-carbon-capture-utilisation-and-storage_208b66f4-en

Ngāwhā geothermal power plant. Operators of most geothermal plants in the Waikato and Bay of Plenty regions are also undertaking reinjection trials. Geothermal reinjection is supported through the NZ ETS (via the ability to apply for a unique emissions factor). More information on geothermal reinjection is included in **Annex One**.

Upstream oil and natural gas producers, particularly those mining natural gas wells with high CO_2 concentration, and some midstream chemical companies have also investigated CCS opportunities here. Some sites in New Zealand, including some natural gas fields in Taranaki, may well be suitable for CO_2 storage.

An enabling framework for CCS supports the general approach for New Zealand to meet its emissions budgets on a least cost basis

Under the Climate Change Response Act 2002 (CCRA), New Zealand has committed to meeting a series of Emissions Budgets and has a target for net zero greenhouse gas emissions by 2050 (other than for biogenic methane).[4]

To achieve these targets, businesses and households will need to make behavioural changes and adopt a mix of technologies and practices to reduce the amount of greenhouse natural gases released into the atmosphere.[5]

Natural gas production and consumption represents a sizeable share of New Zealand's total emissions. In the long term, reducing natural gas consumption could lower carbon emissions, but the pace of decarbonisation will depend on what fuels consumers convert their energy consumption to, the emissions intensity of those fuels, and the energy efficiency of appliances. Transitioning away from natural gas before renewable alternatives are in place can be counterproductive (e.g. resulting in an increase of coal use for electricity generation) and cause significant economic and employment shocks.

An enabling framework for CCS will increase the range of options New Zealand has, alongside other emissions reduction and removals technologies, to achieve emissions budgets. It could also reduce emissions in our 'hard to abate' sectors – such as gas production, and petrochemicals and heavy industries (including the production of fertiliser, methanol, cement, and steel). If deployed, it would decrease the cost of meeting emission budgets.[6] Whether operators choose to deploy CCS as a way to reduce or remove emissions will ultimately depend on commercial factors, namely the cost of using CCS compared to other technologies and options. The Government has signalled it is taking a broad-based approach to reducing net emissions, by making options available through clear enabling frameworks and regulatory settings.

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[4] The Paris Agreement is a legally binding international treaty on climate change. Its overarching goal is to hold "the increase in the global average temperature to well below 2°C above pre-industrial levels" and pursue efforts "to limit the temperature increase to 1.5°C above pre-industrial levels." Since 2020, countries (including New Zealand) have been submitting their national climate action plans, known as nationally determined contributions (NDCs), to communicate actions they will take to reduce greenhouse gas emissions to reach the goals of the Paris Agreement.

[5] https://environment.govt.nz/publications/new-zealands-greenhouse-gas-inventory-19902022-snapshot/

[6] https://www.mbie.govt.nz/dmsdocument/27264-review-of-CCUS-CCUS-potential-in-new-zealand-march-2023-pdf

https://www.mbie.govt.nz/dmsdocument/27344-energy-in-new-zealand-2023-pdf

https://www.mbie.govt.nz/dmsdocument/23550-energy-in-new-zealand-2022-pdf

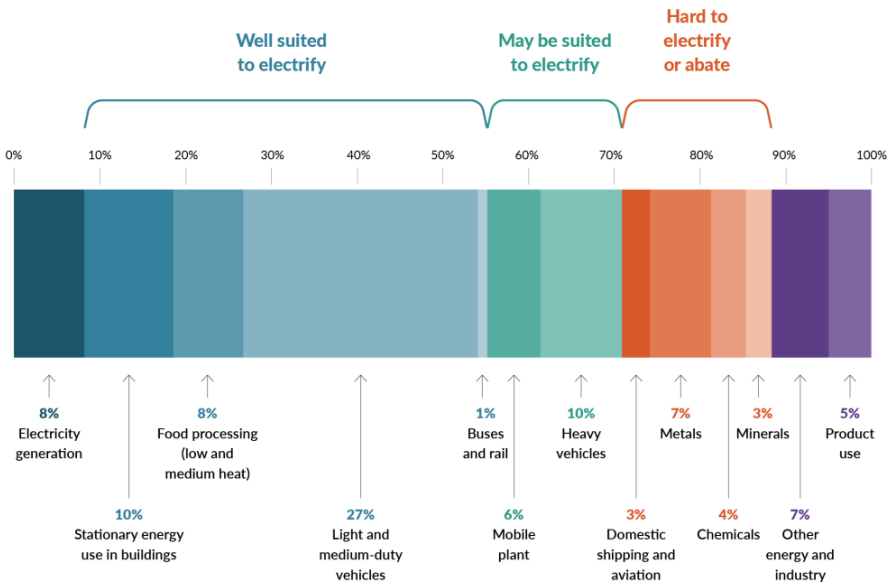


Figure 1. *New Zealand's emissions from the energy sector and industrial processes and product use sector, 2022*

Under status quo regulatory settings, CCS is unlikely to be deployed in New Zealand, outside of geothermal energy production

The Emissions Trading Scheme (**ETS**) provides financial incentives for industries to reduce emissions in New Zealand. It requires businesses that are ETS participants to surrender one 'emissions unit' (known as a New Zealand Unit (NZU)) to the Government for each tonne of emissions they emit. The ETS currently acknowledges emissions removals and sequestration relating to forestry and geothermal activities.

Under the CCRA, forestry activities receive NZUs, and the accounting method for carbon stock changes for forests is set out in the Climate Change (Forestry) Regulations 2022. Under the Climate Change (Unique Emissions Factors) Regulations 2009, a geothermal operator may apply for approval to use a unique emissions factor (UEF) for a particular geothermal plant. Through the use of the UEF, a geothermal ETS participant can subtract CO_2 reinjected into geothermal fields from its ETS liability.

There is no current mechanism in the NZ ETS to reward CCS activities. This is limiting the uptake of CCS as a removal strategy for New Zealand.

This means that:

- there are no clear rules on how to record, calculate and report the emissions removal or sequestration achieved through these CCS activities,
- businesses outside of the forestry and geothermal sectors, such as natural gas producers and natural gas-fired electricity generators, have no clarity about how CCS activities would benefit them in terms of reducing their ETS liability,
- businesses have no clarity about how they would be held liable, if some amount of CO_2 that they injected later leaked into the atmosphere.

This affects industries' ability to assess the business case for investing in CCS activities, thereby reducing the financial incentive to undertake CCS activities. The lack of official rules or direction on what emissions accounting methods would be deemed to be acceptable could undermine the transparency and credibility about the environmental integrity of these projects. For example, estimates of the emissions sequestered by a CCS project would come from the CCS operator, and there might not be a third party who could verify these estimates.

CCS could support energy security by reducing the cost of gas production

Natural gas production in New Zealand is declining more quickly than expected, leading to concerns about security of energy supply. The natural gas sector plays a critical role in the New Zealand economy and natural gas will be a key energy source during our transition to a low emissions economy. This includes it as a source of electricity generation when renewable generation is not able to meet demand.

In response to the current gas supply shortage, the Government has a wider work programme on gas security and has been working with the industry to explore options for addressing investor confidence in the natural gas industry and diversifying natural gas supply.

For example, the Government has committed to repeal the ban on oil and gas exploration to reduce New Zealand's reliance on imported coal and ensure gas can be used as a transition fuel as we move toward Net Zero 2050. The wider work programme is outside the scope of this RIS.

However, if rewarded under the ETS, and businesses subsequently choose to invest, CCS technology could reduce the cost of gas production by providing a means for natural gas producers to reduce their ETS liability, especially for higher CO_2 content gas fields. Were such investment in CCS to occur, this could promote investment and impact the sharp decline in gas production.

CCS could complement this wider programme of work and improve energy security. If a gas producer could reduce its NZ ETS costs through CCS, CCS could lower the (net) cost of producing natural gas, thereby improving the economics of gas production and in turn improving our energy security.

What is the policy problem or opportunity?

Cabinet has agreed to the development of a clear enabling framework for CCUS, including with a view to reducing the costs of gas production. Existing regulatory settings do not sufficiently enable CCS activities because:

- there is no current mechanism to reward CCS, and therefore no incentive for its deployment, and
- if CCS were deployed, and CO_2 later leaked into the atmosphere, the operator that originally injected it would not be liable for the cost of this leakage.

Problem definition part 1: There is no mechanism to reward non-geothermal CCS activities using the NZ ETS

The ETS aims to reward emissions reductions and removals

There are two ways in which a sequestration activity can be rewarded under the NZ ETS:

1. As a removal activity, such as forestry or the destruction of synthetic greenhouse gases, where NZUs are provided as a reward for the sequestration,
2. As a reduction in emissions obligation where the total cost of emissions from a participant is reduced by the volume of emissions reinjected rather than emitted (this happens at some geothermal fields). Currently, this option is only available to operators of geothermal fields.

The current regulatory framework does not enable non-geothermal CCS to be rewarded through the NZ ETS

Neither of the above-listed pathways for NZ ETS recognition are available for (non-geothermal) CCS, under the current regulatory framework. Since any sequestration using CCS is not

recognised, companies would face an ETS unit surrender obligation, regardless of whether they deployed CCS, or not. This means that there is no financial incentive for companies to sequester their emissions using CCS. The cheapest option would be for companies (such as natural gas producers) to continue to vent their CO_2 into the atmosphere, and surrender ETS units.

The Government's strategy is to take a market-led approach to emissions abatement, by using the NZ ETS to incentivise businesses and individuals to reduce their emissions at least cost. Allowing sequestration using CCS to benefit under the NZ ETS would create optionality for where emissions reductions in the economy can occur, if operators viewed it economic to do so relative to other available options. If sequestering one tonne of carbon using CCS was cheaper than polluting or implementing other emission reductions or removal technologies, certain businesses would be incentivised (and have flexibility) to sequester their emissions. However, without an economic incentive, CCS will not be adopted by NZ ETS participants.

CCS could be deployed to reduce the emissions intensity and improve the economics of a range of industries, particularly those involved or connected to the gas sector. This includes:

- Natural gas production, particularly in high CO_2 fields where the CO_2 is vented after being separated out to get the natural gas to pipeline specifications.
- The petrochemical sector
- Natural gas for process heat in the industrial process.
- Other emissions intensive industries.

CCS Opportunities in New Zealand:

Upstream gas production

Enabling CCS could incentivise natural gas field operators to inject CO_2 into some of their wells.

Natural gas production already includes equipment to separate CO_2. (For natural gas to be put into the pipeline network, it must meet a specification that includes only allowing a very small amount of CO_2 to be present). Generally, this CO_2 is vented into the atmosphere, and the operator surrenders NZ ETS units.

For fields with very high CO_2 concentrations this cost can be problematic. This is the case for Maui East, where OMV produces a small volume of gas, which it then blends into the rest of the Maui stream to meet specifications without venting. At Kapuni, the other high CO_2 field, Todd Energy captures a portion of the CO_2 and sells it. The rest of the CO_2 is vented, and also incurs an obligation to surrender NZ ETS units. Kapuni currently provides New Zealand's only domestic sources of CO_2 for commercial and industrial processes.

Under the status quo, these surrender obligations would still apply even if CCS were deployed to store the CO_2 associated with these operations instead of venting it.

Other point source emissions / 'hard-to-abate' sectors

There are several large industries considered strategically important to New Zealand (including steel, cement and chemical industries) which are hard to electrify. Where such high value industries cannot reduce emissions through other means, CCS could play a key role. The IEA notes that, currently, CCS is virtually the only technology solution for deep emissions reductions from cement production, and the most cost-effective approach in many regions to curb emissions in steel and chemicals manufacturing.

However, there has been limited interest in CCS from point source emitters. Apart from Ballance, which is located beside a potential sequestration site, other large point source emitters would face significant transport challenges. In addition, the level of technology readiness is lower for industrial applications such as steel and concrete. These factors combined mean that there would need to be a compelling economic argument for capital to be spent on CCS, to capture and store carbon for industrial processes. These factors are of course subject to change. Technology can mature with overseas development, and the economics could change with higher carbon prices.

CCS could allow certain industries more time to move to lower emissions processes, including electrification. The current pace of the transition may mean they are exposed to carbon prices earlier than they are able to bear them, potentially leading to reduced economic activity.

Geothermal energy
CCS can also be applied to geothermal energy production. Currently, geothermal reinjection is already supported through the NZ ETS (via the ability to apply for a unique emissions factor) and the RMA (under existing approvals for reinjection of geothermal fluid). Further information on existing geothermal reinjection activity in New Zealand is included in Annex One.

And a missed opportunity to support security of energy supply

As noted in the context section, CCS could lower the (net) cost of producing natural gas, thereby improving the economics of gas production and in turn improving our energy security.

However, with no mechanism under the CCRA for gas producers to reduce their NZ ETS costs when they deploy CCS, there is no incentive for them to so.

Problem definition part 2: If CCS was rewarded using the NZ ETS, but CO_2 later leaked into the atmosphere, the CCS operator would not be liable

There is no current ability to make a CCS operator liable under the ETS for CO_2 leakage from a storage site

The Government intends to enable CCS by allowing an operator who injects CO_2 into a geological storage formation to obtain some benefit under the NZ ETS (either of options two or three in the 'Options to reward CCS' section, below). Conceptually, such an NZ ETS reward would be offered on the basis that CO_2 injected into a suitable storage location is not emitted into the atmosphere and is highly unlikely to be emitted into the atmosphere (i.e. to leak) at some future point in time, if sites are well selected, designed, operated and appropriately monitored. If the operator has not emitted CO_2 into the atmosphere, their NZ ETS liability should reduce. However, even if the likelihood of leakage is extremely small, there is still a risk that some amount of injected CO_2 could leak into the atmosphere at some point in future.

If an NZ ETS benefit is given to a CCS operator and the CO_2 were to later leak from a storage formation, the status quo from the perspective of future NZ ETS liability is that a CCS operator would not be liable for the cost of this leakage.

This poses three problems:

- **Socialisation of risk:** the leaked amount of CO_2 would be added to New Zealand's Greenhouse Gas Inventory, at society's expense, and regardless of when that leak occurs. This would conflict with the 'polluter pays principle', since the polluter (e.g., a CCS operator who may have been at fault for the leakage of CO_2 into the atmosphere) would not be required to pay for the cost of their pollution.

- **Frustration of the statutory purpose of the NZ ETS:** the NZ ETS puts a price on emissions, by charging certain sectors of the economy for the greenhouse gases they emit, but CCS operators would not be liable under the NZ ETS for future emissions which occur as a result of leakage, and as the indirect result of their activities.
- **Reduced incentive to ensure storage is permanent:** since CCS operators would not be held responsible under the NZ ETS for leaked emissions, there would be reduced incentive for them to ensure that the risk of leakage into the atmosphere is reduced, and that stored CO_2 is completely and permanently contained.

There is likely to be the need for additional regulatory settings to further manage the risks of any CO_2 leakage from storage sites, that fall outside of the scope of this RIS

Confidential Advice to Government

Regulation is likely to be required to:

- create an obligation for operators to actively monitor for, manage and mitigate those risks during and potentially after CCS activities take place
- ensure that liability for any CO_2 leakage is clearly assigned, including for the period after injection activities cease
- financially protect the Crown, and
- deter risky behaviour.

Such obligations are likely to include monitoring, reporting and verification requirements and would be imposed as an ongoing requirement, as part of an approvals process before CCS activities could begin.

As described in the upcoming scope section of this RIS, the approval and monitoring of CCS projects will be the subject of a subsequent RIS and Cabinet Paper. This RIS focusses on whether the ETS would clearly establish who is liable for possible leakage of CO_2 from a storage site, for how long, and in which way.

What objectives are sought in relation to the policy problem?

The policy objectives of the proposals for providing a more enabling regulatory environment for CCUS are:

a) **Flexible and cost-effective achievement of emissions targets** — creating a level playing field for emissions reduction/removal technologies, by providing flexibility that enables businesses to choose among different abatement options.
b) **Responsible management** — incentivising operators to mitigate any risks of CO_2 leakage, and to ensure that liability is appropriately assigned.
c) **Contribute to energy security** — supporting security of energy supplies during transition towards a low-emission economy by improving the economics of gas production.

Flexible and cost-effective achievement of emissions targets is the primary objective. The responsible management objective is necessary to support the achievement of emissions abatement, and to mitigate the risk of CO_2 leakage into the atmosphere. The CCS policy options could also contribute to achieving the energy security objective, by improving the economics of natural gas production.

Section 2: Deciding upon an option to address the policy problem

What criteria will be used to compare options to the status quo?

The proposals will be assessed against a subset of the criteria in the table below (with specific criteria selected as those relevant to the set of policy options), which have been derived from the above policy objectives.

Criteria	Questions to guide application of the criteria
Level playing field for emission reduction and removal technologies *(double weighted)*	Would the option be effective in contributing toward the creation of a level playing field for emissions reduction/removal technologies, and providing flexibility to enable businesses to choose among different abatement options. *(This has been double weighted as it relates to the primary objective of this policy.)*
Integrity of CO_2 storage	Would the option ensure that the CO_2 storage sites and the emissions sequestered in those sites is monitored and accurately reported? Would the option ensure that the risk of CO_2 leakage from these sites is mitigated? Would the option ensure that the liability for the storage sites is appropriately assigned?
Improve economics of gas production	Would the option contribute to security of energy supplies during transition towards a low-emission economy by improving the economics of gas production?
Implementation complexity	Would the option be complicated or costly for central and local government to implement?
Compliance burden for businesses	Would the option create a significant compliance burden for businesses?
Fiscal risk to the Crown	Would the option effectively manage risk to the Crown in relation to long-term liability for meeting obligations related to CCS projects, including NZ ETS liability for potential CO_2 leakage?

What scope will options be considered within?

Regulatory elements considered in this RIS

In August 2024, Cabinet agreed to a develop a clear, enabling framework for CCUS, including with a view to reducing the costs of gas production.

There are three broad elements needed for any CCS regulatory regime:

- A financial incentive for CCS operators,
- A clear long-term liability framework to deal with CO_2 leaking from the storage site into the atmosphere, and
- A permission and monitoring function.

This RIS deals with the first two elements above, because the third element (plus part of the second) will be the subject of a subsequent RIS (because we are seeking policy decisions from Cabinet in two stages).

The policy options focus on creating a regulatory environment where CCS activities can compete with other emissions reduction and removal technologies on a level playing field when industries consider options for reducing emissions into the atmosphere at least cost. We have not considered options for mandating or subsidising the use of CCS technologies, as these are not consistent with Cabinet decisions.

As part of the options analysis, we have examined overseas regulatory regimes to understand options for emissions accounting and managing long-term liabilities for CO_2 storage sites, particularly those in Australia, Canada, the EU, California, and Norway.

As mentioned in the limitations and constraints section above, officials consider it necessary to undertake further investigation into whether and how the resource management framework could be adapted for approving CCS projects. The proposals for the CCS approval framework and monitoring CO_2 storage sites, which may require changes to the resource management framework, will be in the next report back. Therefore, the RIS does not include detailed discussion on the resource management framework.

Once further proposals are developed, officials will provide a separate regulatory impact analysis on these. These other design parameters of the regime may influence:

- Whether businesses choose to adopt CCS based on their assessment of the cost of complying with permission and monitoring requirements, against the expected economic value from reducing their ETS liabilities from CCS activities.
- The extent and timing of any associated ETS liabilities brought about by any leakage of CO_2 from storage sites.

Scope of CCS activities considered in this RIS

In terms of the scope of CCS activities that this RIS covers we are primarily interested in exploring options to enable CCS where such CCS would be recognised internationally as a reduction in New Zealand's carbon emissions (following the IPCC Guidelines for National Greenhouse Gas Inventories).[7] This means:

- The options cover geological sequestration as defined by the IPCC. Other potential forms of storage (deep ocean storage, mineral carbonation) are at research stage and

[7] Microsoft Word - V2_Ch5_CCS_Final.doc (iges.or.jp)

are not yet covered by the IPCC guidelines, but we would want the regime to be flexible enough to adjust if these technologies develop.

- The options aim to cover CCS regardless of the source of the CO_2. This means it could cover:
    - a party injecting their own emissions, third-party emissions, or CO_2 captured from the atmosphere.
    - CO_2 from fossil fuels or non-fossil-fuel sources such as bioenergy (as the guidelines are clear that negative emissions can arise from the capture of CO_2 generated by biomass).

We note that geothermal reinjection is not covered by this RIS. Geothermal reinjection is already supported through the NZ ETS (via the ability to apply for a unique emissions factor) and the Resource Management Act 1991 (RMA) (under existing approvals for reinjection of geothermal fluid). Moreover, the issues with assigning liability for CO_2 leakage do not arise as geothermal emissions are naturally occurring (beyond those directly associated with geothermal energy production) and so do not contribute to New Zealand's emissions inventory.

What options are being considered?

For the purpose of analysing options, we have split the options analysis into the following areas:

- Options to reward CCS
- Options for the NZ ETS treatment of any leakage of CO_2 into the atmosphere

At the end of this section, we present the overall recommended package of options.

Section 2.1 Options to reward CCS

As set out in the problem definition, there is no current mechanism to reward geological CCS, and therefore no incentive for its deployment. We have identified the following four options to reward NZ ETS participants for geological carbon sequestration under the NZ ETS.

- Option One: status quo (no reward)
- Option Two: NZ ETS obligation reduced to recognise CCS
- Option Three: NZUs rewarded to recognise CCS
- Option Four: recognising and rewarding CCS through a separate carbon credit scheme

Option One – Status Quo

Description and analysis of option

No change to the existing legislative and regulatory structure. Additional forms of CCS, such as from oil and gas, would not be on a level playing field with other emissions reduction and removal technologies when businesses consider abatement options. Therefore, it would remain unlikely that these CCS activities would take place even if enabled by other legislative change (such as to the RMA).

(Note that geothermal reinjection would continue to be available to that sector.)

This could mean that some sectors, particularly the oil and gas sectors, are unlikely to explore CCS as an emissions abatement option. This could mean that New Zealand would have to meet emissions budgets at a higher cost.

Option Two – NZ ETS obligation reduced to recognise CCS

Description of option

Participants who already face an NZ ETS obligation would be enabled to report the CO_2 sequestered as part of their emissions return of CO_2 (and other greenhouse gases) emitted.

The volume of CO_2 sequestered would be subtracted from the volume of CO_2 (or CO_2-e) emitted one-for-one, resulting in a net decrease in the total obligation under the NZ ETS.

This option is agnostic to how the CO_2 is sequestered, and where the CO_2 originates. The entire obligation (including the obligation to verify) will sit with the sequestering participant, who can contractually manage any other relationships.

Analysis of option

Compared to the status quo, this option provides a greater incentive for businesses to deploy CCS and levels the playing field for emissions abatement options. This is achieved by giving NZ ETS participants the ability to reduce their emissions obligation through undertaking CCS projects. This option would require no primary legislative change to the CCRA (though it could be supported by minor clarifications in that Act if an appropriate vehicle arises).

It would require moderate regulatory change, likely to the Climate Change (Stationary Energy and Industrial Processes) Regulations 2009. Potential change could also be necessary to the Climate Change (Liquid Fossil Fuels) Regulations 2008 and the Climate Change (Unique Emissions Factors) Regulations 2009 depending on the relevancy of the 'oil' part of the 'oil and gas sector' in future forms of sequestration.

Any participants would not need to understand and participate in a new scheme, and additional compliance requirements (in terms of emissions reporting and verification) would be minimal.

This option is limited to only participants who already have an emissions obligation. A firm looking to sequester CO_2 via CCS that does not otherwise participate in the NZ ETS and owe an emissions obligation could not be recognised under this option. This means that a firm cannot receive NZUs for CCS unless it has an obligation to surrender NZUs for its emissions.

This option avoids additional complexity associated with providing additional NZUs into the market, and ultimately caps the number of NZUs that could be freed up by the sequestering participant to their total gross emissions.

Option Three – NZUs rewarded to recognise CCS

Description of option

Participants who already face an NZ ETS obligation, or new voluntary participants, would be enabled to report the CO_2 sequestered as part of an emissions return for the removal activity.

The volume of CO_2 sequestered would be rewarded with NZUs one-for-one, resulting in a financial benefit to the participant, either in being able to sell those NZUs or use them to cover the cost of an existing NZ ETS obligation.

This option is agnostic to how the CO_2 is sequestered, and where the CO_2 originates. The entire NZ ETS obligation and related verification requirements sits with the sequestering participant, who can contractually manage any other relationships.

Analysis of option

Compared to the status quo, this option provides a greater incentive for businesses to deploy CCS and levels the playing field for emissions abatement options. This is achieved by rewarding NZ ETS participants with NZUs for CCS. This option would require primary legislative change to the CCRA.

It would also require regulatory change, likely to the Climate Change (Other Removal Activities) Regulations 2009.

Any participants already in the NZ ETS may need to build some new understanding of participating in the removals side of the scheme, but overall would not need to understand and participate in an entirely new scheme. This would create additional compliance requirements (in terms of emissions reporting and verification) but should have efficiencies possible with existing requirements.

This option is not limited to only participants who already have an emissions obligation. A firm looking to sequester CO_2 via CCS that does not otherwise participate in the NZ ETS and owe an emissions obligation could receive NZUs solely as a removal participant. In this case, a firm would receive NZUs without having to surrender any NZUs for meeting emissions obligation—it can trade its surplus NZUs on the NZU trading platform.

This option entails additional complexity associated with providing additional NZUs into the market, and does not cap the NZUs that could be obtained by the sequestering participant to their total gross emissions.

Option Four – Recognising and rewarding CCS through a separate scheme

Description of option

Anyone who (validly) sequesters CO_2 via CCS could participate in a separate scheme, regardless of their participation in the NZ ETS. This separate scheme would allow a business wanting to achieve emissions savings to enter into a contract to claim the emissions savings achieved by a CCS project.

The volume of CO_2 sequestered could still be linked to the NZU, but does not have to be.

The design of this option would determine whether it was agnostic to how the CO_2 is sequestered, and where the CO_2 originates.

Analysis of option

Compared to the status quo, this option provides a greater incentive for businesses to deploy CCS. This is achieved through providing financial reward in a separate scheme, which may not necessarily take the form of an NZU. This option would require either significant primary legislative and regulatory change, or the creation of bespoke primary legislation and supporting regulations.

Any participants already in the NZ ETS would need to build new understanding of participating in the separate scheme, with no or minimal efficiencies possible with existing requirements.

This option is not limited to only participants who already have an emissions obligation under the NZ ETS. A firm looking to sequester CO_2 via CCS that does not otherwise participate in the NZ ETS and owe an emissions obligation could receive recognition solely as a participant in the separate scheme; and, a firm in the NZ ETS would be able to claim reward that could hypothetically counterbalance their net emissions obligation below zero.

This option does not entail additional complexity associated with the provision of NZUs, but it also does not allow for alignment with economy-wide strategies that use the NZ ETS as the key tool for reducing emissions, since it requires the creation of a new form of incentive. Generally, this would create inconsistency in how removals are treated.

What have submitters said about the Government's proposals?

Views on ETS treatment expressed during public consultation on CCUS

Public consultation on creating an enabling regulatory regime for CCS ran between 9 July 2024 and 6 August 2024. MBIE published a discussion document, with questions throughout on high level features of a regulatory regime for CCUS and received 55 submissions in total. Submitters included local iwi, government and non-governmental organisations, civil society and environmental groups, and industry.

Iwi were consulted as part of this general consultation, which covered issues pertaining to the ETS. MBIE also contacted Iwi in Taranaki and Te Tai Tokerau to inform of the consultation and offer discussions. We intend to undertake further engagement with iwi prior to consideration of the December Cabinet paper. This is to ensure the engagement is most useful to both iwi and government, as it is likely to be better informed and fuller than an engagement of only some parts of the CCUS policy proposal. The outcome of that engagement will be covered in a subsequent RIS.

The moana (ocean) around Aotearoa New Zealand is of significant cultural and economic value to Māori. Māori also have formally recognised customary interests, for example under the Marine and Coastal Area (Te Takutai Moana) Act 2011, Ngā Rohe Moana o Ngā Hapū o Ngāti Porou Act 2019 (takutai moana legislation), and Treaty of Waitangi settlement legislation. Any regulatory regime for developing and managing CCS needs to ensure that these interests can be effectively managed.

On the topic of ETS treatment of CCUS activities, key themes from submissions were:

- **CCS should be integrated into the ETS:** Of those submitters who expressed a view on ETS treatment, many agreed that integrating CCUS into the ETS would help incentivise and remove barriers to CCUS uptake.
    - Some submitters that opposed use of CCS also opposed amending the ETS to recognise CCUS activities. Ngā Iwi o Taranaki and some other submitters were also opposed to recognising CCUS removals using the ETS, due to the further emphasis this would place on a net emissions reductions approach, rather than focusing on reducing gross emissions. Ngā Iwi o Taranaki also echoed advice from the Climate Change Commission that the NZ ETS cannot be solely relied upon to drive emissions reductions which need to occur in the second and third emissions budget periods.
- **Different CCS activities should be recognised differently:** Some submitters stated that activities that result in negative emissions, such as bioenergy energy with CCUS or removal technologies should be rewarded more than other CCUS activities. There were also ideas to vary the reward based on factors such as how likely and long captured emissions are expected to stay out of the atmosphere.
- **Enabling either reduced ETS obligations or NZUs for CCUS would support flexibility but double counting needs to be avoided:** Many submitters favoured the flexibility of enabling reduced ETS obligations from CCUS use or allowing users to receive NZUs. Some submitters emphasised the need to prevent double counting if both are allowed, with some also suggesting limiting which CCUS activities can receive NZUs.
- **Recognising CCUS under the ETS may not be enough to encourage use of this technology:** Some submitters noted that CCUS use depends on commercial viability, which is impacted by lower expected gas production levels and lower carbon prices. Some submitters suggested government needs to consider the interplay with CCUS and industrial allocations as well as wider ETS settings.

- Some submitters also suggested that additional incentives may be needed to support CCUS uptake based on overseas experience and if the government wants CCUS to happen.

Reward: How do the options compare to the status quo/counterfactual?

	Option One – Status Quo	Option Two – Reduced Obligation	Option Three – NZU Reward	Option Four – Separate Scheme
Level playing field for emission reduction and removal technologies	0	+ (x2 = + +) Unlike the status quo, option two would allow CCS to be on a level playing field with other emission reduction and removal technologies. The reward under option two only applies to existing NZ ETS participants – but no non-participants are expected to viably carry out CCS in the near future.	+ (x2 = + +) Unlike the status quo, option three would allow CCS to be on a level playing field with other emission reduction and removal technologies. CCS would only be viable to limited entities (eg direct air capture).	0 Option three would provide better incentive for CCS than the status quo. CCS would only be viable to limited entities. However, this option risks misalignment with the economy-wide approach to incentives under the NZ ETS as the key tool for reducing emissions.
Integrity of CO_2 storage	0	+ Direct management of environmental integrity would not sit under NZ ETS – to be addressed in second RIS on permission and monitoring. However, unlike the status quo, rewarding CO_2 storage creates an economic incentive to avoid leakage.	+ Direct management of environmental integrity would not sit under NZ ETS – to be addressed in second RIS on permission and monitoring. However, unlike the status quo, rewarding CO_2 storage creates an economic incentive to avoid leakage.	+ Direct management of environmental integrity would not sit under NZ ETS – to be addressed in second RIS on permission and monitoring. However, unlike the status quo, rewarding CO_2 storage creates an economic incentive to avoid leakage.
Improve economics of gas production	0	+ Better than the status quo. Depending on factors like NZU prices, the reward for CCS under this option could improve the economics of gas production and therefore contribute to energy security.	+ Better than the status quo. Depending on factors like NZU prices, the reward for CCS under this option could improve the economics of gas production and therefore contribute to energy security.	+ Better than the status quo. Depending on factors like NZU prices, the reward for CCS under this option could improve the economics of gas production and therefore contribute to energy security.
Implementation complexity	0	0	-	- -

	Option One – Status Quo	Option Two – Reduced Obligation	Option Three – NZU Reward	Option Four – Separate Scheme
		Similar to the status quo. This would be relatively simple to recognise through minimal changes to existing NZ ETS regulations, and no primary legislative change.	This would require primary legislative change, and the introduction of a new removal activity with similar complexity to forestry.	This would require new primary legislation, or significant legislative change, to create an entirely new scheme.
Compliance burden for businesses	0	0 There will likely be additional data and verification burden for participants, but overall aligns with existing emissions reporting with which participants are familiar under the status quo.	- Will require separate emissions reporting for a separate activity, and the management of more NZUs flowing in more directions.	- - Will require understanding a new scheme, and participating in this scheme in addition to the NZ ETS.
Fiscal risk to the Crown	0	- Not rewarding NZUs simplifies management of liability for leakage.	- - Rewarding NZUs complicates management of liability for leakage.	- Not rewarding NZUs simplifies management of liability for leakage.
Overall assessment	0	**+3**	**0**	**–3**

Example key for qualitative judgements:

++	much better than doing nothing/the status quo/counterfactual
+	better than doing nothing/the status quo/counterfactual
0	about the same as doing nothing/the status quo/counterfactual
-	worse than doing nothing/the status quo/counterfactual
- -	much worse than doing nothing/the status quo/counterfactual

Reward: What option is likely to best address the problem, meet the policy objectives, and deliver the highest net benefits?

Options Two and Three are both considered important pathways for enabling CCS recognition under the NZ ETS. Both options perform better than the status quo under the criteria of "Level playing field for emission reduction and removal technologies", "Integrity of CO_2 storage", and "Improve economics of gas production". This is mainly because both of these options provide better financial incentive for businesses to sequester their emissions using CCS than the status quo. The better financial incentive could translate to better economics of gas production and therefore contribute to strengthening our energy security, although this would depend on factors such as NZU prices, the cost of CCS technologies and expected gas production volumes.

It is worth noting that neither of Options Two nor Three scored positively, with regard to fiscal risk to the Crown, compared to the status quo. This is because both options provide a reward for businesses undertaking CCS, but if CO_2 later leaks into the atmosphere (outside of the injection period), it is unclear whether those businesses would face a surrender obligation under the NZ ETS. (Without clear assignment of liability, the Crown may be expected to act as an insurer of last resort. Long-term liability for CO_2 leakage into the atmosphere is dealt with under a separate set of Options, in Section 2.2, below).

Considering all criteria, Option Two scored most strongly compared to the status quo. Generally, this option would be much more straightforward to implement, both in practice and in terms of the lowest extent of legislative/regulatory change. It will also enable the most likely deployments of CCS in New Zealand to be incentivised, without needing the added implementation complexity of Option Three.

However, Option Three is likely to be more relevant in the future, and in some ways is superior to Option Two, especially if direct air capture technology becomes more common and achievable, and/or if non-NZ ETS participants wish to set up CCS activities. Many of the implementation challenges that affected its score are also manageable over a slightly longer timeframe, and efficiencies can be achieved alongside other parts of this policy process (i.e. that will be covered in the second RIS) that will also require primary legislative change.

Section 2.2 Options for assignment of responsibility for CO_2 leakage into the atmosphere

As set out in the problem definition, this set of options addresses the question of who should be responsible under the NZ ETS if some quantity of injected CO_2 leaks from a geological storage formation.

These options assume that a CCS project has been consented, and that an approvals process for CCS projects has been put in place. Such a process would establish clear legal requirements for monitoring, reporting and verification, geological suitability assessments, and corrective action. Ongoing monitoring is necessary to determine whether CO_2 is contained in the storage formation. Options for a fit-for-purpose approvals and monitoring regime will be considered in a subsequent RIS and Cabinet Paper.

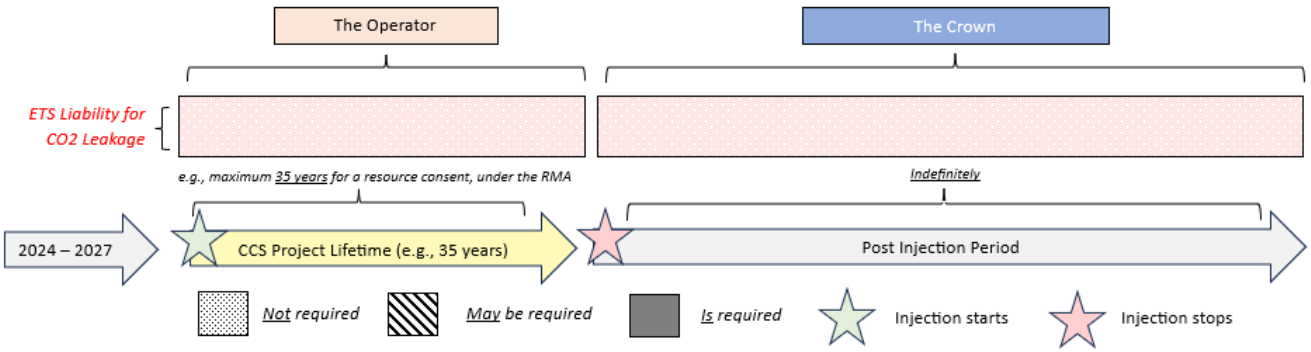
We have identified the following options for the assignment of responsibility for CO_2 leakage into the atmosphere:

- Option One – The Status Quo.
- Option Two – Operator initially responsible under the NZ ETS for potential CO_2 leakage, but liability will transfer to the Crown, once injection operations cease, and if conditions are met.
- Option Three – Operator initially responsible under the NZ ETS for potential CO_2 leakage, but liability may transfer to the Crown, once injection operations cease, after some period, and if conditions are met.

These options also assume that a more onerous long-term liability regime is more likely to discourage investment. The extent to which this assumption holds true is likely to vary with the presence of different factors, including the future carbon price, the future cost of abatement, and the risk of CO_2 leakage. These matters are further explored in Annex Two.

Option One – The Status Quo

The operator would not be able to claim any NZ ETS benefit for injection and geological storage of CO_2. Whether captured CO_2 was stored, or vented into the atmosphere, the capturer would be required to surrender a commensurate volume of units, under the NZ ETS. Consequently, during the post-injection period, the operator of a CCS project would not be financially liable under the NZ ETS, if CO_2 which it injected into a geological storage formation, later leaked into the atmosphere, after injection operations ceased.



Analysis of option

This option would not require any change to primary or secondary legislation. Potentially, the operator would still be liable for other harms and adverse long-term effects caused by its activities, depending on their degree, severity and nature, and whether these harms, or

performance of any other conditions (such as monitoring), were covered as a condition of a discharge consent, or any other consent, bond or other condition, given or provided for under the directions of the RMA (s108, s108AA, s108A, etc.).

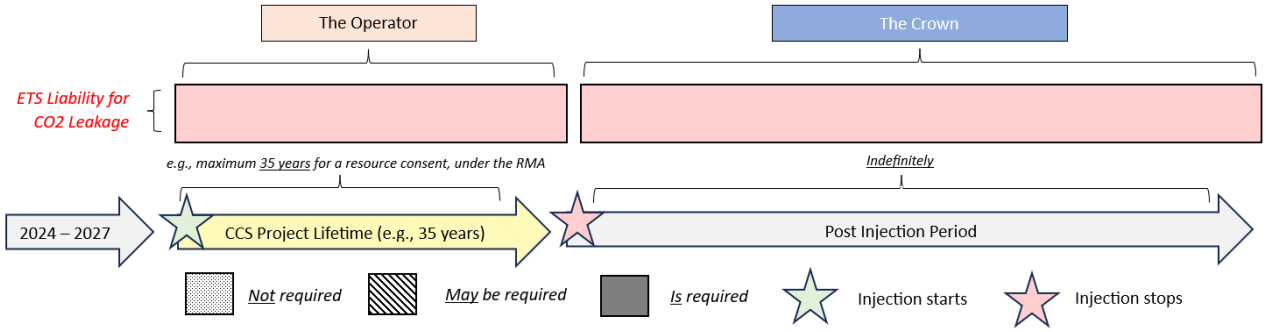
Since any stored CO_2 would have already been counted under the NZ ETS as an emission, possible leakage of that CO_2 would not be double counted toward New Zealand's international climate change targets and obligations. Consequently, the Crown would not be obligated to account for these emissions, except to the degree that such leakage may have contributed to some other harm or adverse environmental effect.

This option assumes that a CCS operator would not receive any NZ ETS benefit for injecting and storing CO_2.

Option Two – Operator initially responsible under the NZ ETS for potential CO_2 leakage, but liability <u>will</u> transfer to the Crown, once injection operations cease, and if conditions are met

This option assumes that a CCS operator would be able to claim an NZ ETS benefit for injection and geological storage of CO_2 (either of options two or three in the 'Options to reward CCS' section, above). During the injection period, the operator of a CCS project would be liable under the NZ ETS for any amount of CO_2 previously injected into a geological storage formation, that leaks into the atmosphere, and for which they received an NZ ETS benefit.

Once injection operations have ceased, and if the operator has satisfactorily met all obligations and conditions that have been placed upon it during the injection and closure phases, and if all available evidence suggests that stored CO_2 will be completely and permanently contained, the Crown would assume NZ ETS liability for potential leakage of CO_2 from that storage location.



This option does not consider long-term liabilities for corrective action, or monitoring of locations where CO_2 has been injected. Responsibility for these obligations will be considered as part of subsequent decisions. It is intended that a monitoring regime will be developed and put in place.

Analysis of option

This option establishes two periods: an injection period, and a post-injection period; and, requires that a CCS operator would only be liable for any CO_2 leakage that occurs during the injection period.

This option would ensure that a CCS operator who had claimed a benefit under the NZ ETS for sequestering CO_2 would be liable under the NZ ETS for any potential leakage of CO_2 that occurred during the injection period. However, it would also establish a strong expectation that liability for stored CO_2 would transfer to the Crown:

- once injection operations have ceased,

- if the operator has satisfactorily met all obligations and conditions that have been placed upon it during the injection and closure phases (for instance, a consent condition established by a consent authority under the RMA), and
- if all available evidence suggests that stored CO_2 has been completely and permanently contained.

That is, the Crown would be liable for any CO_2 leakage in the post-injection period.

To illustrate:

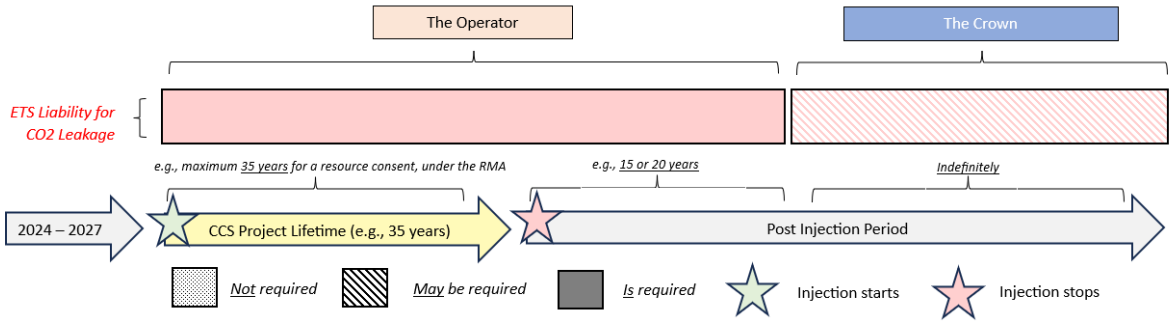
- a gas producer sequesters 500,000 tonnes of CO_2 between year one and year five
- its NZ ETS obligation would reduce by 500,000 tonnes in that period,
- the gas producer stops injecting in year six, and closes the site,
- all conditions have been met by the operator, and all available evidence suggests that the CO_2 has been completely and permanently contained,
- the Crown becomes liable for stored CO_2 from year six onwards,
- however, 20,000 tonnes of CO_2 leaked from the geological storage reservoir in year fifty,
- the Crown would take responsibility for this leakage, and 20,000 tonnes of CO_2 would be added to New Zealand's Greenhouse Gas Inventory in that year.

In the event of possible CO_2 leakage into the atmosphere, this option would provide the lowest degree of financial protection to the Crown than the other available. However, this option is more likely than any of the other available options to incentivise CCS investment, since it establishes a strong expectation that once injection operations cease, and if conditions are met, long-term liability for CO_2 leakage will transfer to the Crown, and the operator will be indemnified, and absolved of any future surrender obligation under the NZ ETS.

Option Three – Operator responsible for a number of years post-operation ceasing under the NZ ETS for potential CO_2 leakage, but liability may transfer to the Crown, once injection operations cease, and if conditions are met

This option assumes that the operator would be able to claim an NZ ETS benefit for injection and geological storage of CO_2 (either of options two or three in the 'Options to reward CCS' section, above). During the injection period, the operator of a CCS project will be liable under the NZ ETS for any amount of CO_2 previously injected into a geological storage formation, that leaks into the atmosphere, and for which they received an NZ ETS benefit.

Once injection operations have ceased, and if the operator has satisfactorily met all obligations and conditions which have been placed upon it during the injection and closure phases, and if all available evidence suggests that stored CO_2 has been completely and permanently contained, and if some period of time has elapsed (e.g. 15, or 20 years) the Crown may choose to assume NZ ETS liability for potential leakage of CO_2 from that storage location.



Analysis of option

As with Option Two, this option establishes two periods: an injection period, and a post-injection period; and, requires that a CCS operator would be liable for any CO_2 leakage that occurs during the injection period.

However, it would also establish an expectation that liability for stored CO_2 *may* transfer to the Crown:

- once injection operations have ceased,
- if the operator has satisfactorily met all obligations and conditions that have been placed upon it during the injection and closure phases (for instance, a consent condition established by a consent authority under the RMA),
- if all available evidence suggests that stored CO_2 has been completely and permanently contained,
- and after an acceptable period of time has elapsed.

The expectation of NZ ETS liability transferring from the operator to the Crown would be weaker than the one which applies to Option Two, since, ultimately, the Crown would be in a position to *choose* whether to accept NZ ETS liability for possible future CO_2 leakage, or not.

If the Crown was not satisfied that CO_2 had been completely and permanently contained at the site, liability for potential CO_2 leakage into the atmosphere would continue to reside with the operator.

Further, this decision could only be taken if the above-listed conditions were met, and only after an acceptable length of time had elapsed. In the EU, this minimum period is 20-years, while under the Australian Commonwealth model, it is 15-years. The present option does not propose what this minimum length of time would be, only that it be acceptable. If this option is agreed to by Cabinet, the acceptable length of time, and other details, will be considered in a separate Cabinet report back and RIS.

To illustrate this option:

- a gas producer sequesters 500,000 tonnes of CO_2 between year one and year five
- its NZ ETS obligation would reduce by 500,000 tonnes in that period,
- the gas producer stops injecting in year six, and closes the site, but remains liable,
- some acceptable length of time passes,
- all conditions have been met by the operator, and all available evidence suggests that the CO_2 has been completely and permanently contained,
- the Crown chooses to indemnify the operator,
- the Crown becomes liable for stored CO_2 from that point, onwards,

- however, 20,000 tonnes of CO_2 leaked from the geological storage reservoir in year fifty,
- the Crown would take responsibility for this leakage, and 20,000 tonnes of CO_2 would be added to New Zealand's greenhouse gas inventory in that year.

In the event of possible CO_2 leakage into the atmosphere, this option would provide a lesser degree of financial protection to the Crown than the status quo, but more financial protection to the Crown than Option Two. This option is more likely than the status quo to incentivise CCS investment, but less likely to incentivise CCS investment than Option Two, since it establishes a weaker expectation that once injection operations cease, and if conditions are met, long-term liability for CO_2 leakage ***may*** transfer to the Crown.

Views on long-term liability expressed during public consultation on CCUS

On the topic of long-term liability relating to potential impacts of CCUS activities, key themes from submissions were:

- **The long-term liability regime will impact the overall attractiveness of CCS investment opportunity:** Industry submitters supported indemnity after a period of time, post site-closure, with some divergence on details:
    - Most supported long term liability transfer after 15 years, like Australia. *(See BEC and ERA submissions)*
    - Other industry submitters, particularly Todd Energy, took a stronger view, that the liability regime for CCS in New Zealand should be less stringent than the Australian regime, due to the difference in potential CCS economics, particularly in the natural gas sector. NZ point sources are more widely distributed, and economy of scale may be harder to achieve. Gas volumes are decreasing, while up front capital costs remain fixed. Long run profit margins are therefore likely to be smaller for CCS applied to natural gas production. Operators could be given flexibility, with a pathway to apply for an indemnity early if it can be evidenced that CO_2 will be permanently contained. The liability regime should also be flexible, and account for varying risk profiles of different projects (eg., onshore vs offshore, developed vs. greenfield).
- **Government should not seek to promote CCS through weak regulatory settings that shift cost and risk to taxpayers:** Several non-industry submitters did not support indemnifying CCS project operators. These submitters argued that introducing considerably less onerous requirements, for the sake of improving the attractiveness of CCS investment, may not be right. Regulatory burden is a cost, but if the cost is well-considered, and fairly accounts for the assumed profile of risks and benefits, but happens to reduce the attractiveness of abatement using CCS, then that would simply suggest that CCS is uneconomic at current carbon prices, and without further incentives. Indemnification of CCS operators would be an implicit subsidy in the face of a low expected carbon price, at the potential expense of future taxpayers (who would become liable for any future CO_2 leakage).
    - Ngā Iwi o Taranaki were opposed to the possibility of liability transfer from a potential operator to the Crown, and suggested that there should be perpetual liability for Ministers who approve the operation of storage sites, even after closure.
- **Industry opposed to trailing liability:** Industry submitters were also generally opposed to potential trailing liability requirements, since this would decrease the attractiveness of CCS investment opportunities.

Liability: How do the options compare to the status quo/counterfactual?

	Option One – Status Quo	Option Two – Operator initially responsible under the NZ ETS for potential CO_2 leakage, but liability <u>will</u> transfer to the Crown, once injection operations cease, and if conditions are met	Option Three – Operator responsible for a number of years post-operation ceasing under the NZ ETS for potential CO_2 leakage, but liability <u>may</u> transfer to the Crown, once injection operations cease, and if conditions are met
Level playing field for emission reduction and removal technologies	0	**+ (x2 = ++)** This option provides businesses with greater flexibility to choose between different abatement options, since it jointly establishes (in combination with some option to reward CCS activities under the NZ ETS) an economic incentive to undertake CCS activities, and an expectation that the operator will be liable for potential CO_2 leakage, until operations cease. However while better than the status quo, this option puts CCS on an unlevel playing field, compared with other forms of sequestration that are recognized under the ETS, since it makes CCS operators liable for their emissions during the injection period, but means that they may be absolved of any liability for emissions that occur (i.e. leakage) during the post-injection period, if conditions are met.	**+ (x2 = ++)** This option provides businesses with greater flexibility to choose between different abatement options, since it jointly establishes (in combination with some option to reward CCS activities under the NZ ETS) an economic incentive to undertake CCS activities, and an expectation that the operator will be liable for potential CO_2 leakage, until operations cease. In this case, the expectation of liability transfer is slightly weaker, and therefore the incentive also. However while better than the status quo, this option puts CCS on an unlevel playing field, compared with other forms of sequestration that are recognized under the NZ ETS, since it makes CCS operators liable for their emissions during the injection period, but allows that they may be absolved of any liability for emissions that occur (i.e. leakage) during the post-injection period, after some period, if conditions are met, and if the Crown agrees.
Integrity of CO_2 storage	0	**+** Incentive to ensure CO_2 does not leak during the injection phase, but no incentive to reduce risk during the post-injection phase.	**++** Incentive to ensure CO_2 does not leak during the injection phase, and for some time afterwards, once injection operations stop.

	Option One – Status Quo	Option Two – Operator initially responsible under the NZ ETS for potential CO_2 leakage, but liability **will** transfer to the Crown, once injection operations cease, and if conditions are met	Option Three – Operator responsible for a number of years post-operation ceasing under the NZ ETS for potential CO_2 leakage, but liability **may** transfer to the Crown, once injection operations cease, and if conditions are met
Improve economics of gas production	0	++ Compared to the status quo, this option may significantly limit the liability a CCS operator could face, and therefore more business certainty for investments in CCS projects. Depending on other factors like NZU prices, the business case for CCS would be much stronger under this option. This could significantly improve the economics of gas production Should a gas producer invest in CCS, it would contribute to energy security.	+ Compared to the status quo, this option could potentially reduce the long-term liability a CCS operator faces, but there remains some uncertainty about whether the Crown will take over the liability in the long term. Depending on other factors like NZU prices, the business case for CCS could be slightly stronger under this option. This could improve the economics of gas production to some extent. Should a gas producer invest in CCS, it would contribute to energy security.
Implementation complexity	0	- - This option would require change to primary and secondary legislation. The Crown would have to monitor and manage the risk of leakage from CO_2 storage sites in the post-injection period.	- This option would require change to primary and secondary legislation. The Crown may or may not have to manage the risk of leakage from CO_2 storage sites, depending on whether the Crown decides to take over the long-term liability after undertaking a risk assessment.
Compliance burden for businesses	0	- This option involves a greater compliance burden for businesses, as it involves compliance for CCS activities that would not otherwise take place under the status quo.	- This option involves a greater compliance burden for businesses, as it involves compliance for CCS activities that would not otherwise take place under the status quo.
Fiscal risk to the Crown	0	-	-

	Option One – Status Quo	Option Two – Operator initially responsible under the NZ ETS for potential CO_2 leakage, but liability **will** transfer to the Crown, once injection operations cease, and if conditions are met	Option Three – Operator responsible for a number of years post-operation ceasing under the NZ ETS for potential CO_2 leakage, but liability **may** transfer to the Crown, once injection operations cease, and if conditions are met
		Compared to the status quo, this option creates fiscal risk to the Crown, since it establishes that liability *will* transfer. Fiscal risk remains low, as this option assumes any conditions are met.	Compared to the status quo, this option creates fiscal risk to the Crown, since it establishes that liability *may* transfer. Fiscal risk remains low, as this option assumes any conditions are met.
Overall assessment	0	**+1**	**+2**

Liability: What option is likely to best address the problem, meet the policy objectives, and deliver the highest net benefits?

Option 3 scored most strongly compared to the status quo. It establishes that the operator would be financially liable for any CO_2 leakage under the NZ ETS, during the injection period, and for some time afterwards. This would ensure that the cost of CO_2 leakage would not be borne by society during the injection period, and for some time afterwards.

The injection period, and during the first few decades of the post-injection period, are the two periods of time when CO_2 is most likely to leak.[8]

Option 3 would also reduce the likelihood that the purpose of the NZ ETS (which is to ensure that businesses pay a cost for their emissions) is frustrated or confused if CO_2 leaks, by establishing an expectation that businesses will be liable for their emissions due to potential leakage, unless all available evidence demonstrates that CO_2 has been completely and permanently contained, and the Government chooses to indemnify the operator, after some period, and if conditions are met.

The possibility of transfer of liability also provides an added incentive for firms to undertake CCS responsibly, by reducing the likelihood that operators who comply with all conditions and obligations will be perpetually liable for CO_2 which they inject.

[8] Juan Alcalde, Stephanie Flude et al, “Estimating geological CO_2 storage security to deliver on climate mitigation” (2018) Nature Comms 9:2201, doi: 10.1038/s41467-018-04423-1.

Recommended package of options

We recommend a package of policy proposals that would create a more enabling regulatory environment for CCUS activities, including:

- **Options to reward CCS:** Option Two: NZ ETS obligation reduced to recognise CCS

Our analysis suggests that Option Two would be the preferred option for providing an economic incentive for the forms of CCS that are most likely to be economic in the immediate term. However, Option Three is likely to be more relevant in the future, plus is in some ways superior to Option Two, especially if direct air capture technology becomes more common and achievable, and/or if non-NZ ETS participants wish to set up CCS activities.

- **Options to assign liability for CO_2 leakage into the atmosphere:** Option Three – Operator initially responsible under the NZ ETS for potential CO_2 leakage, but liability may transfer to the Crown, once injection operations cease, after some period, and if conditions are met.

Our analysis suggests that Option Three would be the preferred option, since it establishes an expectation that the operator would be liable for CO_2 leakage, but also allows that liability for future CO_2 leakage *may* transfer to the Crown in future, some time after injection operations have ceased, and if conditions can be met (such as providing of evidence that permanent sequestration has been achieved). This would provide added incentive for businesses to sequester CO_2 using CCS, compared with the status quo, whilst creating an acceptable level of fiscal risk to the Crown. To ensure that the 'polluter pays principle' is still taken into account, it may be that the Crown would not accept liability for CO2 leakage into the atmosphere (or other damages), if the operator is determined to have been at fault (e.g., through providing deficient data, concealment of relevant information, negligence, wilful deceit or a failure to exercise due diligence). This option will be covered in a subsequent RIS, which will elaborate on the issue of general liability (i.e., not just for CO2 leakage into the atmosphere, but also other harms which may occur).

What are the marginal costs and benefits of the recommended package?

We have not undertaken a full quantitative cost-benefit analysis (**CBA**) because it is unclear whether the recommended CCS package in this RIS alone would result in CCS projects being undertaken in New Zealand, and whether it would unlock greater gas production. Uncertainties in NZU price and costs of CCS and other emission abatement technologies in the future have also added to the challenges of undertaking a quantitative CBA.

The potential economic benefit of CCS varies from project to project. It depends on factors such as the potential storage capacity, geological risk, and the operational costs of the CCS operator. In the case of a gas producer, the expected gas production volume, gas prices and NZU prices would be a key determinant of the commercial viability of a CCS project. A quantitative assessment of the net economic benefits of a CCS project would require access to commercially sensitive information held by the businesses looking into CCS feasibility, which we do not hold.

The assessment of the marginal costs and benefits of the recommended package is outlined in the table below. An indication of potential savings in emission costs achieved through CCS in New Zealand is included in the table.

Affected groups *(identify)*	**Comment** *nature of cost or benefit (e.g. ongoing, one-off), evidence*	**Impact** *$m present value where appropriate, for*	**Evidence Certainty** *High, medium, or*

	and assumption (e.g. compliance rates), risks.	*monetised impacts; high, medium or low for non-monetised impacts.*	*low, and explain reasoning in comment column.*
Additional costs of the preferred option compared to taking no action			
Regulated groups	Costs associated with reporting and verifying emissions reduction associated with CCS, where an NZ ETS participant undertakes CCS.	The costs in monitoring CO_2 storage sites could be in the range of tens of thousands of dollars to hundreds of thousands of dollars per survey, depending on the monitoring technology deployed.[9]	Medium The estimates are based on overseas research. The costs in New Zealand could be different.
Regulators	Costs associated with administering new NZ ETS regulations on CCS, including gathering information from CCS operators, providing guidance, and updating NZ ETS registry	Low The number of CCS projects is expected to be low in the near term because of the economics of CCS technologies. There will be a fixed cost associated with making changes to the ETS Regulations under the CCRA. This cost will be absorbed as a part of agency baselines. We note that, in Australia, the regulator for offshore CCS uses levies to recover the costs associated with compliance, monitoring and enforcement activities. Its annual well levy is AUD 6,220 per site. [10]	Medium, depending on further development of detailed design of the reporting and verification regime.

9 https://climit.no/app/uploads/sites/4/2020/05/2020-01-Monitoring-and-Modelling-of-CO_2-Storage.pdf

10 https://www.nopsema.gov.au/sites/default/files/documents/NOPSEMA%20Cost%20Recovery%20Implementation%20Statement%202024-2026.pdf#:~:text=This%20Cost%20Recovery%20Implementation%20Statement%20(CRIS)%20provides%20information%20on%20how

Others (e.g. wider govt, consumers, etc.)	Central government will need to undertake risk assessment when determining whether to take over the long-term liability for CO_2 storage sites. Local government could face increase consenting applications for CCS projects. Iwi and landowners could have to respond to engagement enquiries regarding development of CO_2 storage sites.	Low The cost would depend on businesses seeking approval for CCS projects. Based on our engagement with potential users, it is most likely there will be either one or no CCS deployment in the next five to ten years It would be no cost if no business seeks approvals for CCS project.	Medium
Total monetised costs		N/A	N/A
Non-monetised costs		*Low*	*Medium*
Additional benefits of the preferred option compared to taking no action			
Regulated groups	Reducing emissions costs of NZ ETS participants undertaking CCS activities.	There might not be any CCS project outside of geothermal in New Zealand.[11] This would mean no emissions cost savings. In the scenario where a major gas producer deploys CCS in New Zealand, approximately 1000 KT/e of CO2 could potentially be sequestered between 2026 and 2030, and 900 KT/e could be sequestered between 2031 and 2035. Assuming a carbon price of $50/t, this	Medium. The amount of emission cost savings would depend on multiple factors, such as the timing of the CCS projects, carbon price movements, technological developments, the economic environment, and the ability to overcome technical challenges in

[11] The emissions cost savings from geothermal CCS activities is not taken into account, as the geothermal sector is already undertaking CCS, and the recommended proposal aims to enable non-geothermal CCS activities.

		would translate to emission cost savings of $50 million between 2026 and 2030 and $45 million between 2031 and 2035. .	CO_2 injection operations.
Regulators	Gaining insights into CCS activities. Better oversight of activities that could contribute to New Zealand's emissions targets.	Low	High
Others (e.g. wider govt, consumers, etc.)	Creation or retention of local jobs. Development of technical expertise in CCUS. New economic opportunities for Māori groups should there be CCUS projects in their rohe (tribal area) Electricity and natural gas consumers could enjoy more stable electricity and natural gas prices	Low The number of CCS projects is expected to be low in the new future. This means that only a small number of CCS-related jobs (if any) would be created. Those jobs if created could potentially be filed by existing professionals leaving the mining industry (who would have transferrable skills). There are around 6,700 people working in the mining sector in New Zealand.[12]	Medium
Total monetised benefits		N/A	N/A
Non-monetised benefits		Low	Medium

[12] Statists New Zealand (2024), *Labour market statistics: March 2024 quarter*, https://www.stats.govt.nz/information-releases/labour-market-statistics-march-2024-quarter/.

Section 3: Delivering an option

How will the new arrangements be implemented?

Legislative changes and timeline

This section focuses on the implementation of the recommended options for the treatment of CCS activities under the NZ ETS, and the assignment of responsibility for potential CO_2 leakage into the atmosphere, in relation to ETS obligations only. The recommended policy package assessed in this RIS may require primary legislative amendment to the CCRA, and the creation of new NZ ETS regulations.

The *Climate Change (Stationary Energy and Industrial Processes) Regulations 2009* will need to be amended to enable ETS participants to reduce their ETS obligation through undertaking CCS. The *Climate Change (Liquid Fossil Fuels) Regulations 2008* and the *Climate Change (Unique Emissions Factors) Regulations 2009* might also need to be amended. The Ministry for the Environment is expected to lead the development of the amendments to these NZ ETS-related regulations and consult with stakeholders as part of the regulation-making process.

It is intended the ETS regime for CCS activities will come into effect as soon as possible to provide investment certainty for potential CCS operators. Amendments to the CCRA and the NZ ETS regulations on CCS are expected to come into effect in early 2026 at the earliest.

Potential CCS operators' implementation

Potential CCS operators are expected to start or update the feasibility assessments for their CCS projects just before or soon after the NZ ETS regulations on CCS are finalised. Should they establish a clear business case for the project, they will have to apply for the appropriate approvals. While we have not finalised the proposal for the approval framework, we expect that potential CCS operators will have to seek resource consents,

CCS operators, who will be existing NZ ETS participants, will have to meet additional emissions reporting and verification requirements specific to CCS activities. Subject to further development of the details of the regulations on these requirements, they are expected to have to monitor leakage and migration of CO_2, and the safety and integrity of the storage site at least until the liability of the site is transferred to the Crown. They will have to report information on these matters, and provide any other evidence that may be requested by the regulator or consenting authorities for the purpose of assessing leakage risk. It will be necessary for CCS operators to undertake or commission geological surveys to provide accurate information.

EPA's role in implementation

Existing penalties under the CCRA are expected to apply to non-compliance with reporting and verification requirements for CCS activities. To help NZ ETS participants become familiarised with the new requirements, we expect that the Environmental Protection Authority (**EPA**), which carries out regulatory functions under the CCRA, will provide guidance on the new NZ ETS-related regulations on CCS, once those regulations are finalised and gazetted.

The EPA will likely incur additional operational costs as a result. However, these are yet to be quantified because the details of the CCS regulatory regime are still being developed. The report back to Cabinet on the outstanding parts of the CCS regulatory regime will include advice on the financial implications of rolling out the whole regime.

Implementation risks

This RIS only covers the high-level NZ ETS treatment of CCS activities undertaken by existing NZ ETS participants, and who will be liable for emissions leakage from CO_2 storage sites under the NZ ETS. The implementation risks and the corresponding risk mitigation measures from the NZ ETS perspective are outlined in the table below.

Risk	Mitigation measure
Risk of double-counting emissions reduction achieved through CCS projects	Further consultation with stakeholders as MfE develops the NZ ETS regulations on CCS-related emission reporting and verification requirements under the NZ ETS. We expect that there will be some requirements for evidence to demonstrate an exclusive right to claim the emissions reduction. Some checks and balances in the NZ ETS registry may also need to be developed.
Fiscal risk to the Crown, if the Crown chooses to accept liability for possible leakage of CO_2 into the atmosphere	Detailed conditions and requirements to establish exactly when, how, and under what circumstances liability may (or may not) transfer to the Crown, will be established in a later report back to Cabinet. It is expected that one requirement will be a risk assessment, which considers whether the risk of future CO_2 leakage is negligible, or highly unlikely to occur.
Risk of onerous compliance burden undermining confidence in CCS investments	Further consultation with stakeholders as MfE and MBIE develop the detailed design of the CCS regulatory framework. The compliance burden associated with the NZ ETS rules on CCS should be relatively small, as NZ ETS participants already have some experience in NZ ETS-related compliance activities. Some submitters noted that the design of the CCS liability regime could impact confidence in CCS investments. The detailed design of that regime is not covered by this RIS. There will be further consultation on the liability regime.
Environmental risks associated with CCS activities	This RIS focuses on the NZ ETS treatment of CCS. There will be a separate RIS on the other components of the CCS regulatory framework, namely the framework for granting approvals for CCS projects. It is expected that the approval framework will include some requirements for monitoring and managing environmental risks.

All of the above-mentioned risks have been noted by submitters during public consultation.

How will the new arrangements be monitored, evaluated, and reviewed?

The NZ ETS is reviewed periodically. We expect that the NZ ETS regulations on CCS activities would be reviewed as part of any broader NZ ETS reviews in the future. These future NZ ETS reviews could examine the impact of new NZ ETS rules on emissions reduction/removal

associated with CCS activities, and survey data on industry's perception of the NZ ETS impacts.

There will be opportunities for any implementation issues and unintended consequences of the regulatory regime to be raised through reporting and engagement with stakeholders. For more minor improvements and corrections for the NZ ETS regime, such as updating emissions factor values and other technical amendments, there are usually annual updates to the regulations under the CCRA, which occur alongside the ‘Limits and Price Control Settings for Units’ process.

The details of the framework for granting approvals for CCS activities are still being developed. The plans for monitoring, evaluation and review of the approval framework will be discussed in a separate RIS.

The NZ ETS regime for CCS will need to interact with the remaining parts of the CCS regulatory regime (namely the framework for granting approvals for CCS projects and monitoring them). While those remaining parts are still being developed, we consider that the review of those parts should ideally be in sync with the NZ ETS review. The timing of the review could be influenced by factors, such as overseas CCS-related policy and market developments, future government priorities and government agencies’ resource availability.

Annex One: Geothermal Energy and CCS in New Zealand

CCS could play an important role in reducing emissions from geothermal power generators. During geothermal energy production, high temperature water is extracted, the heat used to generate electricity, and the water returned to the underground reservoir. Normally gases including CO_2 which are present in the water are vented, which causes the emissions from geothermal energy. When CCS is used, the CO_2 is captured before it is vented and then dissolved back into the water before it is reinjected underground. This CO_2 is then reabsorbed into the underground reservoir.

About 0.43 Mt of carbon emissions are produced a year. CCS is easier and cheaper to put in place in geothermal plants, compared to coal or gas fired power plants, since geothermal plants already having a process to separate gas and to reinject it, and are located directly on top of the reinjection location.

Under the Climate Change (Unique Emissions Factors) Regulations 2009, a geothermal fluid user may apply for approval to use a unique emissions factor (UEF) for a particular geothermal plant. Using the UEF, a geothermal ETS participant can subtract CO_2 reinjected into geothermal fields from its ETS liability. To reduce its ETS obligation, Ngāwhā has been trialling the reinjection of CO_2 into the ground. CO_2 is dissolved into the geothermal reinjection liquid and pumped back underground instead of being vented. The reinjected CO_2 then becomes part of the existing geothermal reservoir.

Top Energy had budgeted six million dollars for the project, but the project team delivered it at only “a couple of hundred thousand dollars.” As the geothermal fluid was already returned underground, any extra infrastructure needed to reinject the CO_2 was minimal. In the first half of 2023, about 35,000 tonnes of CO_2 equivalent (tCO_2-e) was re-injected back underground at Ngāwhā. This represents a saving about 2.5 million dollars’ worth of emission units at a carbon price of $70 per tCO_2-e. Once all the power plants at Ngāwhā reinject their GHG emissions, the annual carbon credit savings could reach $10m a year at that carbon price. The company has set a goal of becoming fully net zero by the end of 2025

Annex Two: Additional comment on the economics of CCS

Additional factors (aside from the scale and degree of long-term liability for CO_2 leakage), which may also influence a firm's willingness to invest in CCS, are:

- up-front capital expenditure costs,
- operating and decommissioning costs,
- present and future carbon prices,
- economies of scale,
- the quantity of CO_2 available to be captured and stored,
- perceived long-term risk of a CCS project, and
- the cost of remediating potential CO_2 leakage into the atmosphere.

The expected cost of remediating CO_2 leakage into the atmosphere will depend heavily on the expected future carbon price, or cost of future abatement, since it is assumed that the cheaper of either option will be used to offset and account for the impact of this CO_2 leakage.

Many of these same factors will also influence the degree to which the Crown is likely to be financially protected (or exposed to financial risk). For instance, if a larger volume of CO_2 has been injected and stored, and future carbon prices are expected to be considerably higher than at present, then this poses greater long-term financial risk to the Crown, if the Crown assumes long-term liability for potential CO_2 leakage, and if some volume of CO_2 were to leak. This is because financial risk to the Crown from potential CO_2 leakage (during a period where it has assumed liability for potential CO_2 leakage – as allowed for in Options 3 and 4) may be roughly conceptualised as a function of expected total volume of stored CO_2, multiplied by the long-term risk of leakage, multiplied by the expected future carbon price, or expected cost of future abatement.

Financial risk to Crown (if liability transfers) =
Volume of Stored CO_2
x Likelihood of CO_2 Leakage
x (Future Carbon Price OR Cost of Future Abatement)

What is the 'likelihood of CO_2 leakage'?

The 'likelihood of leakage' in the below equation is hypothetical, but likely to be extremely low, in a scenario where the storage location is suitable, and injection activities are properly regulated. The Intergovernmental Panel on Climate Change (IPCC) has written[13] that:

> *For large-scale operational CO_2 storage projects, assuming that sites are well selected, designed, operated and appropriately monitored, the balance of available evidence suggests the following:*
>
> *It is very likely the fraction of stored CO_2 retained is more than 99% over the first 100 years.*
>
> *It is likely the fraction of stored CO_2 retained is more than 99% over the first 1000 years.*

[13] https://www.ipcc.ch/site/assets/uploads/2018/03/srccs_wholereport.pdf

A more recent study by Alcalde, Flude, et al., (2018) published in Nature Communications[14] argues that the outcome of any risk assessment of CO_2 leakage from CCS activities would necessarily vary, depending on the length of the period under consideration (i.e., how far into the injection of post-injection period), the characteristics of the storage formation (i.e., whether CO_2 has been injected onshore or offshore), and whether CCS activities were properly regulated.

If CO_2 has been contained in a storage formation for longer, then long-term physical trapping processes (e.g., mineralization) are more likely to have occurred. If CO_2 was injected onshore, then the density of abandoned and legacy wells which penetrate into a storage formation may be greater (compared with an offshore operation) and, thus, the risk of CO_2 possibly leaking from one of those abandoned wells is assumed to be greater, also.

If CCS operations are properly managed and regulated, with well-considered tests and legal requirements for geological suitability, permitting, monitoring, reporting, verification, corrective action, and (the focus of the present set of options) clear assignment of long-term liability for possible CO_2 leakage, then the likelihood of future leakage due to human error, poor judgement, or some other 'irregularity', will be significantly reduced.

The authors of that same study estimate that, in a 'worst case scenario' (with poor regulation, and in a region with a high risk of leakage from abandoned wells), *"at least 78% of the CO_2 injected will remain trapped in the subsurface over 10,000 years."* Said differently, 22% of injected CO_2 is likely to leak over 10,000 years, in a worst-case scenario, according to this study.

Seismicity

Several submitters raised concerns about the potential for CCS to trigger seismic events, or be impacted by seismic events which occur naturally. The IPCC has assessed[15] that the risk of 'induced seismicity' from CCS (i.e., CCS activities triggering a potential earthquake) is low: "*The fact that only a few individual seismic events associated with deep-well injection have been recorded suggests that the risks are low. Perhaps more importantly, these experiences demonstrate that the regulatory limits imposed on injection pressures are sufficient to avoid significant injection-induced seismicity*."

On the question of whether the security of geologically stored CO_2 is likely to be impacted by seismic activity and tectonic movement, the answer, according to one highly cited study[16], is yes. As the seismic risk is site-specific, we expect that this risk will be considered on a case-by-case basis within the framework for granting approvals for CCS projects. There will be a separate Cabinet report back and RIS on the approval framework.

[14] https://www.nature.com/articles/s41467-018-04423-1

[15] https://www.ipcc.ch/site/assets/uploads/2018/03/srccs_wholereport.pdf

[16] https://www.pnas.org/doi/full/10.1073/pnas.1202473109

Annex Three: Additional options for assigning liability for CO_2 leakage not detailed in this RIS

We have given consideration to alternative ways of addressing liability for CO_2 leakage:

- Liability levy

  Rather than maintaining a liability if carbon leaks from the sequestration site in the future, sequestering entities could pay an up front levy that is set at a level relative to the risk of leakage.

  This would not necessarily, therefore, match with the price of carbon at the time that leakage occurs (if any), but would not require any continued participation in the NZ ETS by the sequestering entity if they close the site or otherwise dissolve.

  However, it would introduce an additional system, and net reduce the initial incentive of participating in the scheme.

- Adjusted reward

  While the in-principle approach is to reward all sequestered carbon at a rate of 1:1 (i.e. one tonne of carbon stored is worth as much as one NZU), the total reward received for CCS could be less than the value of the total volume of carbon stored.

  That is, using example numbers only, an entity earning NZUs or reducing their NZ ETS obligation must forfeit the reward associated with 20 out of 100 tonnes of carbon sequestered, so that any leakage up to 20% of the stored carbon does not result in any liability to themselves or the Crown.

  They would effectively receive 80% of the value of the carbon stored; however, importantly, this would be characterised as receiving a reward for 80 out of 100 tonnes of carbon sequestered, rather than each tonne only being worth 80% of an NZU, in order to align with the consistent value of the NZU to other sectors and to maintain the 1:1 link between carbon stored versus carbon emitted.

These options will interface with (and require consideration of) other liabilities and obligations which could be imposed upon a CCS operator. For instance, obligations to monitor according to specific requirements, or take corrective action in the event of some adverse event or irregularity, will inform the level of risk present for CCS activities (perceived, and actual). An overall approach to managing long-term liabilities (including for possible local adverse environmental effects) will be considered in a subsequent RIS.