PEMBINA Institute

SUBMISSION

Growing Carbon Storage in Alberta

Pembina Institute comments and recommendations

Submitted to Alberta Environment and Protected Areas

Regarding: DRAFT Quantification Protocol for CO_2 Capture and Permanent Geologic Sequestration

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Recommendations

- The Pembina Institute recommends that the quantification methodology be revised for emissions from off-site electricity generation to allow for environmental attributes purchased through market-based mechanisms such as virtual power purchase agreements.
- A higher voluntary discount rate should be considered for projects that carry a higher risk of reversal.
- Re-introducing a minimum allowable storage depth of 1,000 metres below ground would ensure stored CO_2 remains in a dense state, reducing the risk of reversal.

Context

The Pembina Institute welcomes the opportunity to provide input on the development of the carbon capture and storage (CCS) solutions by providing comments on the "Quantification Protocol for CO2 Capture and Permanent Geologic Sequestration."

The update to the quantification protocol is welcome to further clarify accounting in hub-and -spoke CCS models, a key to attracting future investment in Alberta and decarbonizing existing industry.

Discussion

Inclusion of carbon dioxide removal label

The Pembina Institute is pleased to see the inclusion of a carbon dioxide removal (CDR) credit label for activities that permanently remove CO_2 from the atmosphere. While the label does not provide any significance within the Technology Innovation and Emissions Reduction (TIER) system, its inclusion is a significant step towards recognizing the differences between removal and reduction activities.

The inclusion of a wider range of CO_2 sources, including CO_2 captured from direct air capture (DAC) facilities and biogenic sources, offers several different types of CDR systems the ability to generate removal credits on the Alberta Emission Offset Registry. This is a strong step towards enabling the province to capitalize on emerging technologies and support the development of growing industries.

The Pembina Institute welcomes future increased flexibility to allow for a wider range of CO_2removal activities to meet the requirements of the removal label, beyond activities that store CO_2 deep underground. A technology-agnostic approach governed by quality dimensions, rather than process requirements, would provide a robust framework for the removal label without prematurely supporting specific technologies.

While the sustainable sourcing of biogenic carbon will be managed through facility regulation, the Pembina Institute suggests consideration of counterfactuals into the accounting methodology, i.e., what emissions or removals would have occurred in relation to the biomass, had it not been used in this project? In certain cases, the harvesting of biomass might cause a reduction of a natural carbon sink. Taking this into account would add to the robustness of the quantification methodology and potentially mitigate unintended consequences.

Emissions Accounting for Off-Site Electricity Generation

Current technologies used for DAC are energy intensive, requiring 1.3 – 2.3 GJ of electricity per gross tonne of CO_2 captured and compressed.[1] Operational emissions subtract from the product being delivered — the removal of atmospheric carbon — and therefore need to be minimized. Thus, the effective deployment of DAC projects hinges on access to renewable electricity.

While the carbon intensity of Alberta's grid is relatively high compared to other provinces, DAC developers are attracted to the province because of its deregulated electricity market structure.

[1] International Energy Agency, *Direct Air Capture* (2024). https://www.iea.org/energy-system/carbon-capture-utilisation-and-storage/direct-air-capture

The market allows developers to directly purchase renewable electricity from independent power producers through virtual power purchase agreements (vPPAs). These contracts differ from unbundled renewable energy certificates in that the environmental attributes are tied to a specific generating project. The vPPA directly enables the generating project to be built, thereby creating additional renewable energy capacity. In return, the buyer can retire the environmental attributes acquired to lower the emissions of its electricity use.

The use of environmental attributes from vPPAs within emissions quantification methodologies is already commonplace, including by TIER-compliant emitters through wind and solar generation protocols within the Alberta Emission Offset System.

The Pembina Institute recommends that the project quantification methodology be modified to allow for contracted environmental attributes to factor into the net emissions calculations within this protocol. Without this, DAC developers will need to build their own renewable energy generating projects behind-the-meter, adding to project complexity and upfront capital cost, and reducing market potential. Optimal locations for DAC projects within the province would greatly diminish, as projects would have to consider ideal wind or solar generating locations on top of existing geographic constraints such as access to subsurface storage.

The likely consequence is that DAC developers would opt not to use this protocol and instead choose to generate credits through international voluntary carbon credit standards, which largely recognize environmental attributes from vPPAs. Aligning with international voluntary carbon credit standards would both improve market flexibility for developers and increase the utilization of the protocol.

Discount Rates

The Pembina Institute welcomes efforts made to mitigate post-closure reversal risk with the application of a 0.005 discount factor applied to all project developers during the offset crediting period. While we do not have a comment on whether this discount factor is aggressive enough to sufficiently cover the potential of post-closure reversals in the future, it aligns with the quantification protocol for enhanced oil recovery, and we agree with the rationale at this stage, although we do recommend that discount factors are set at such a level sufficient to comprehensively mitigate the impact of reversals.

Providing a flexibility mechanism for project developers to limit true-up liability in the case of a reversal event to three years of average carbon sequestered should provide additional certainty to credit purchasers to reduce liability of credit reversals. Similarly, we do not have a comment on whether the voluntary increase in discount factor from 0.005 to 0.01 is sufficient to cover the potential for reversals in the offset crediting and post-crediting, pre-closure period.

Furthermore, a higher discount rate should be applied to projects that may carry more risk of reversal. For example, a project injecting CO_2 into depleted oil and gas reservoir, might pose a higher risk than saline aquifer sequestration due to the number of legacy wellbores penetrating the subsurface trapping mechanism.[2] Projects that carry less risk as indicated by their site-specific risk assessments should be encouraged with lower discount factors.

Minimum storage depth

The previous version of this protocol defines deep saline aquifers appropriate for CO_2 storage as having a depth of at least 1,000 metres underground, but this definition has been removed in this current draft version. Sufficiently high temperature and pressure is required for CO_2 to reach a supercritical state, which is significantly denser than gaseous CO_2. If CO_2 is stored in conditions with insufficient temperature and pressure, it may expand into a gaseous phase and be more likely to rise to the surface. Storing CO_2 at shallower depths increases the risk of reversal for most trapping mechanisms.

The draft protocol acknowledges this need for sufficient pressure and temperature but does not define a minimum required depth. It is recommended to re-introduce the minimum depth of 1,000 metres underground. A flexibility mechanism with a risk adjusted discount rate could be considered for projects utilizing trapping mechanisms that do not rely on the CO_2 being in a dense state.

Conclusion

In closing, the Pembina Institute would like to express gratitude for the enabling of a competitive CCS industry in Alberta and recognizing a growing CDR industry. These technologies are critical to decarbonizing the province's largest emission sources. Thank you for the opportunity to provide written comments on the "Quantification Protocol for CO2 Capture and Permanent Geologic Sequestration." The Pembina Institute looks forward to continued engagement in this issue.

[2] Government of Alberta. *Carbon Capture & Storage Summary of the Regulatory Framework Assessment*. (2013) Appendix D, 24. https://open.alberta.ca/dataset/5483a064-1ec8-466e-a330-19d2253e5807/resource/ecab392b-4757-4351-a157-9d5aebedecd0/download/6259895-2013-carbon-capture-storage-summary-report.pdf