

Is permanent Carbon Capture and Storage (CCS) an effective solution to the Climate Change Crisis?

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Summary

Permanent storage of CO₂ (CCS) is potentially inadequate, expensive, ineffective and unsafe. Money would be more wisely spent by concentrating on research on the natural processes of CO₂ capture by weathering and uptake by plants, and on energy efficiency.

Method

Different methods of geological storage of CO₂ were evaluated. Permanent CCS, such as the Shell Quest and Weyburn projects, were compared to the geological storage by natural weathering of basic silicates and the uptake of CO₂ by plants.

Observations

CCS is considered necessary in Alberta to reduce CO₂ emission numbers (Lawton *et al.*, 2017 and Figure 1), but it is potentially inadequate, expensive, ineffective and unsafe. Money would be spent wiser by concentrating on research on the natural processes of CO₂ capture by weathering

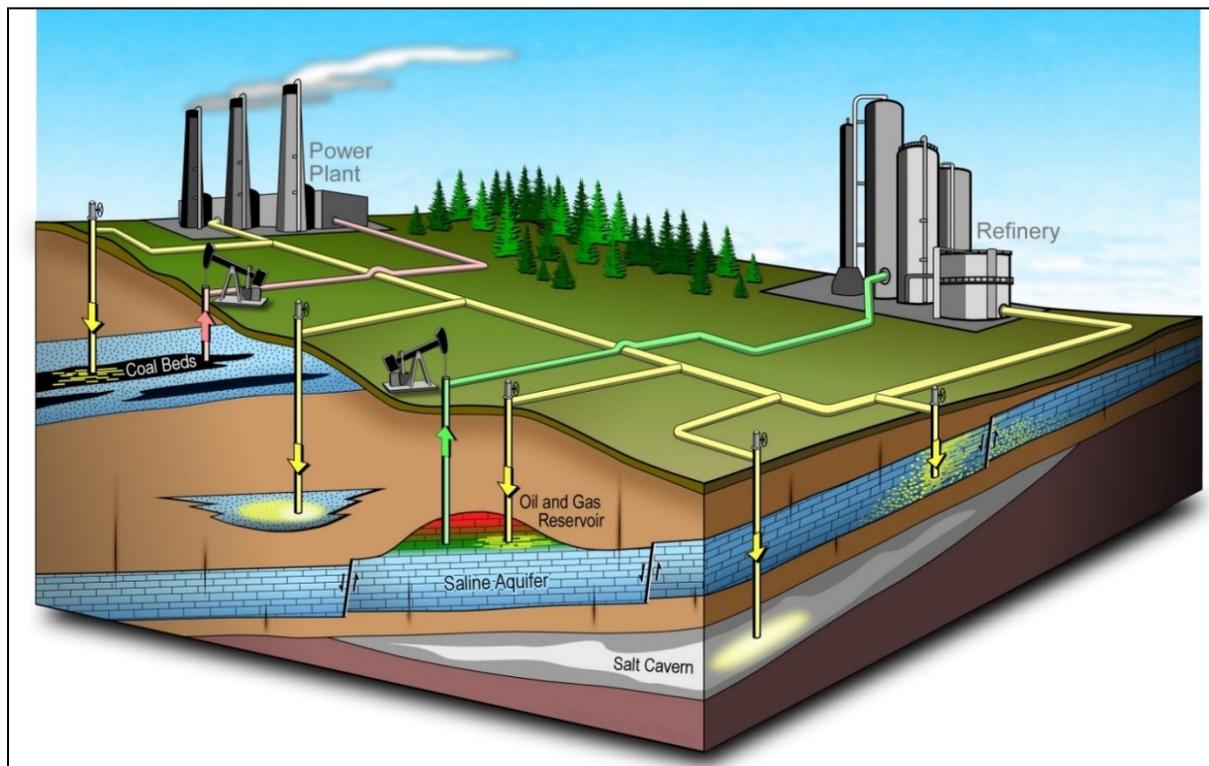


Figure 1. CCS in Alberta

and plants, and on energy efficiency.

Global CO₂ emissions are 49 GT per year of which 22.5 GT enters the atmosphere. Governments are now considering permanent CCS of possibly 1 GT of CO₂ per year, which is only 4.4% of the emissions that enter the atmosphere. The cost of storing 1 GT per year is about \$100 billion per year, assuming a cost of \$100/tonne.

Furthermore, stored CO₂ has the potential of leaking out over time. The present oil and gas resources present about 10% of what was generated and stored over geologic time. The rest leaked out during this time. Almost certainly 90% of the stored CO₂ will leak out in the future. This means that huge amounts of money needed for CCS are wasted (Langenberg, 2010). For this reason, permanent storage projects such as the Shell Quest and Weyburn projects are wrongly considered proven technology.

A critical concern is that CCS is storing a deadly chemical (supercritical CO₂) underground at high temperature and pressure. CCS is wrongly called geological storage because there is no natural geological process that captures low pressure CO₂ and stores it at high pressure in depleted gas fields or saline aquifers. The capture of CO₂ happens in geology naturally by the weathering of basic silicates. Resulting bicarbonate solutions are transported to the oceans where they are transformed into carbonate rocks. This is the ultimate sustainable geological storage of CO₂ (Schuiling, 2018 and Hamilton *et al.*, 2020). Another sustainable natural process is the capture of CO₂ by plants.

With the same amount of money used to develop CCS, more CO₂ could be captured in this safer and more sustainable manner.

Conclusions

CCS is potentially inadequate, expensive, ineffective and unsafe. The capture of CO₂ happens in geology by the weathering of basic silicates and in biology by the uptake by plants. Money would be better spent on research on the natural processes of CO₂ capture by weathering and uptake by plants, and on energy efficiency, than on CCS.

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