Upstream decarbonization through a carbon takeback obligation: An affordable backstop climate policy

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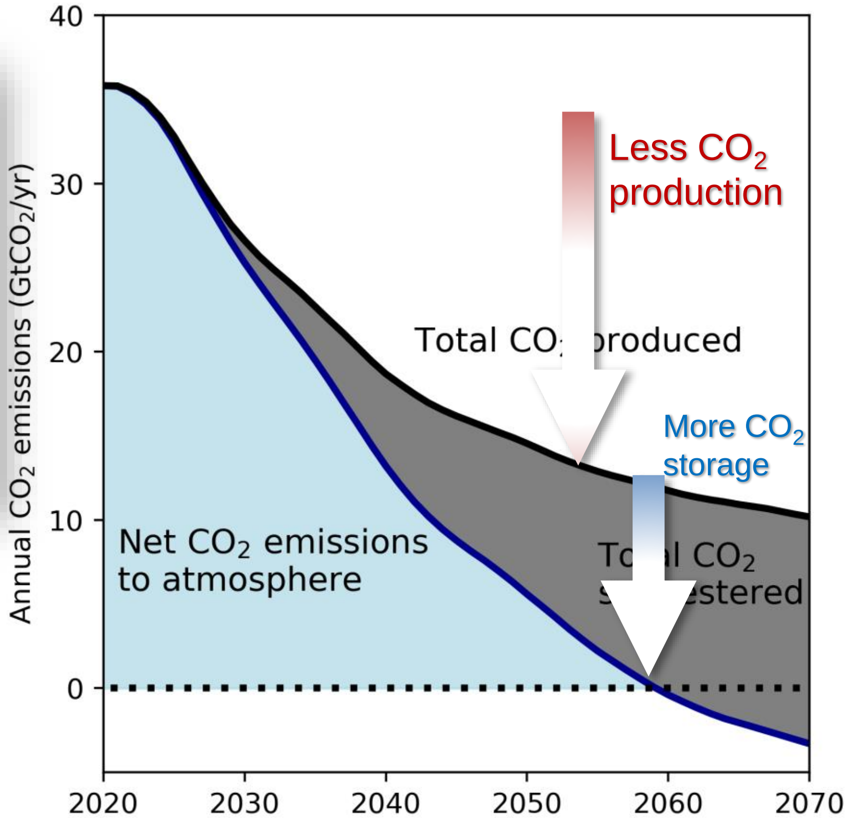
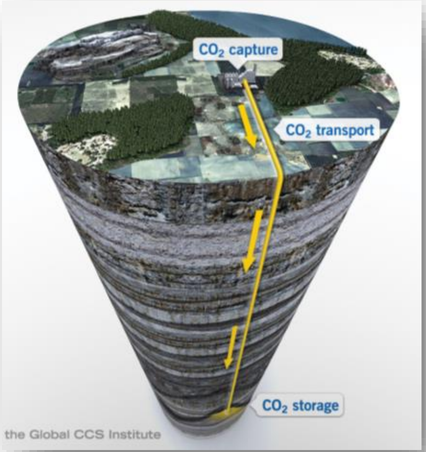
The Oxford Net Zero initiative

We need geological CO_2 storage to meet Paris goals





Global CO_2 production and storage from energy and industry in average "technology neutral" scenarios that limit warming to about 1.5°C

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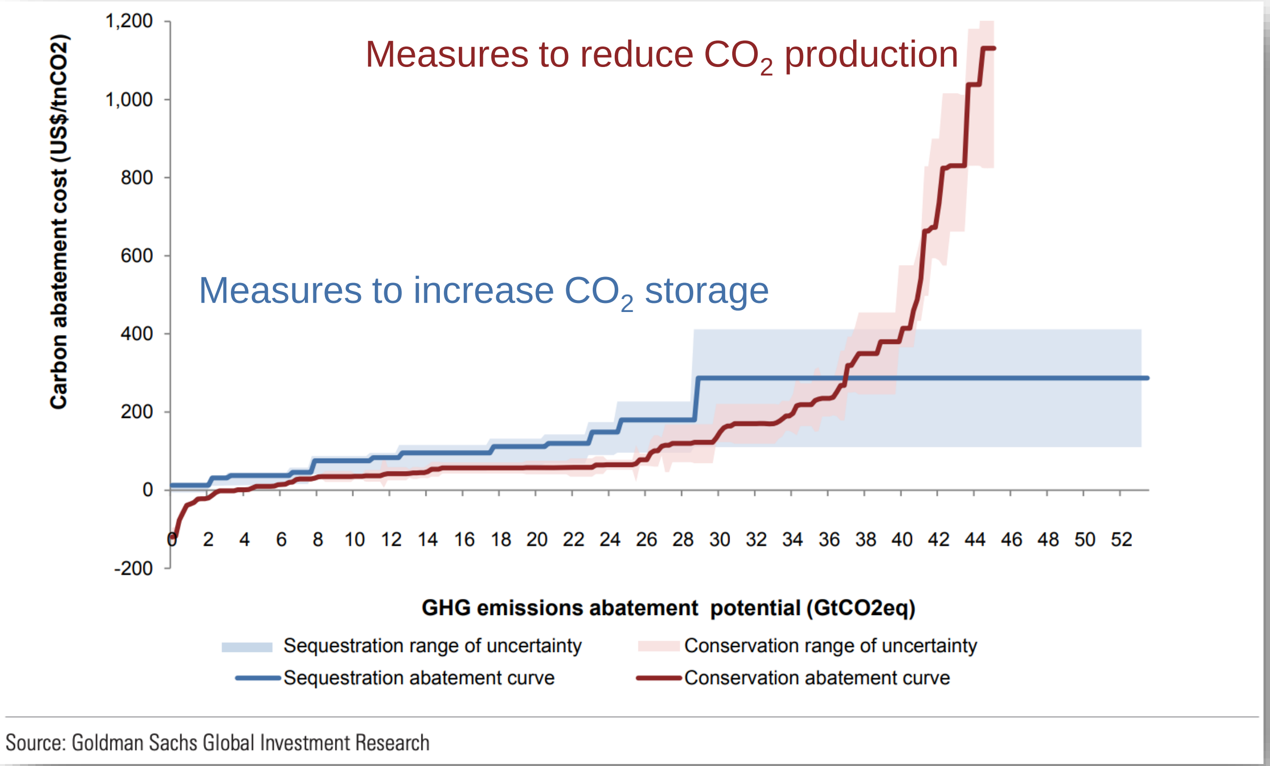
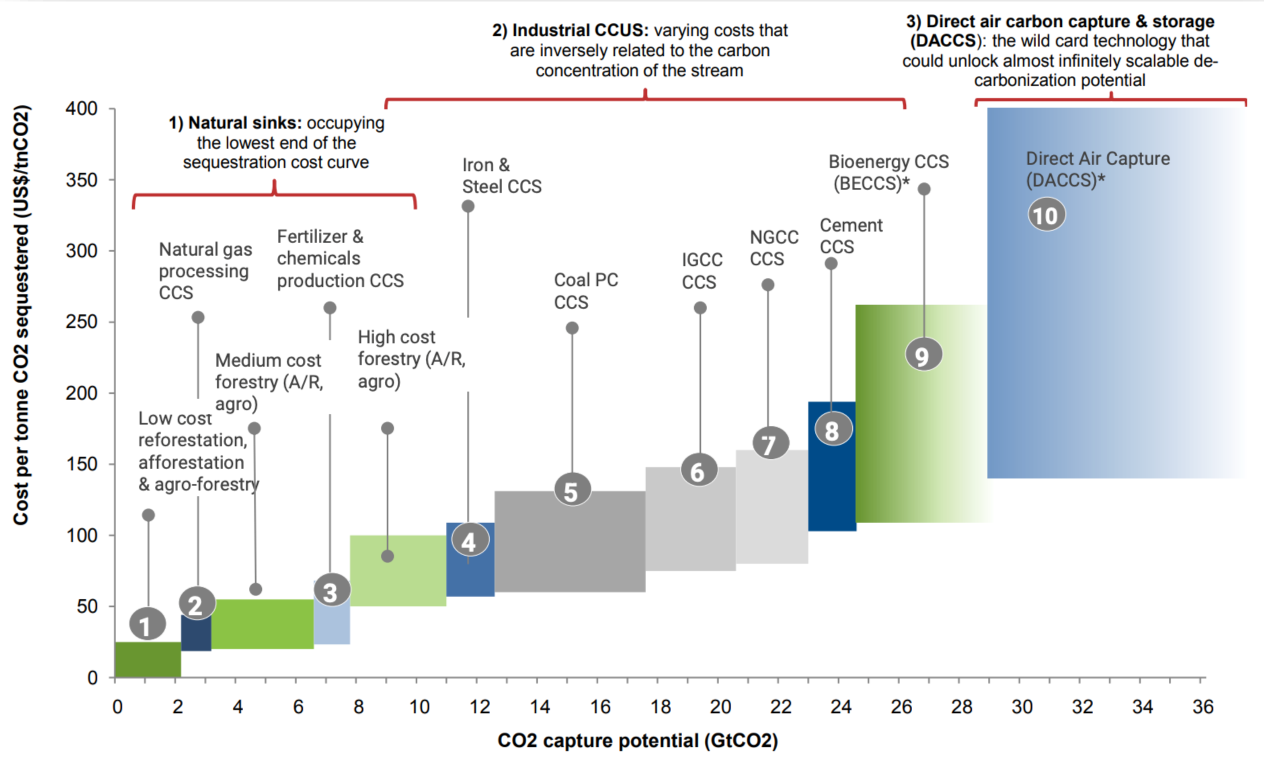
But it is still starved of investment: and here is why



For 75% of emissions reductions, it is cheaper to reduce CO_2 production than increase CO_2 storage

https://www.goldmansachs.com/insights/pages/gs-research/carbonomics-10-key-themes-from-the-inaugural-conference-f/report.pdf

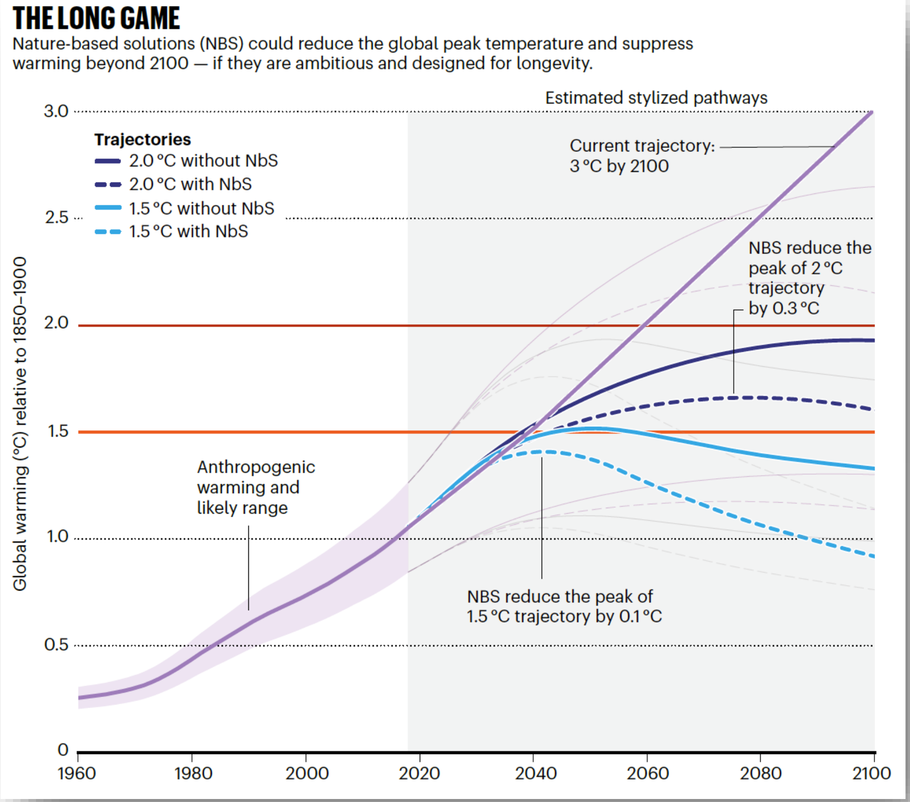
Costs of nature-based and geological carbon dioxide storage options



Costs of geological storage options depend on source, starting at <$50/t$CO_2$, rising to >$250/tCO_2

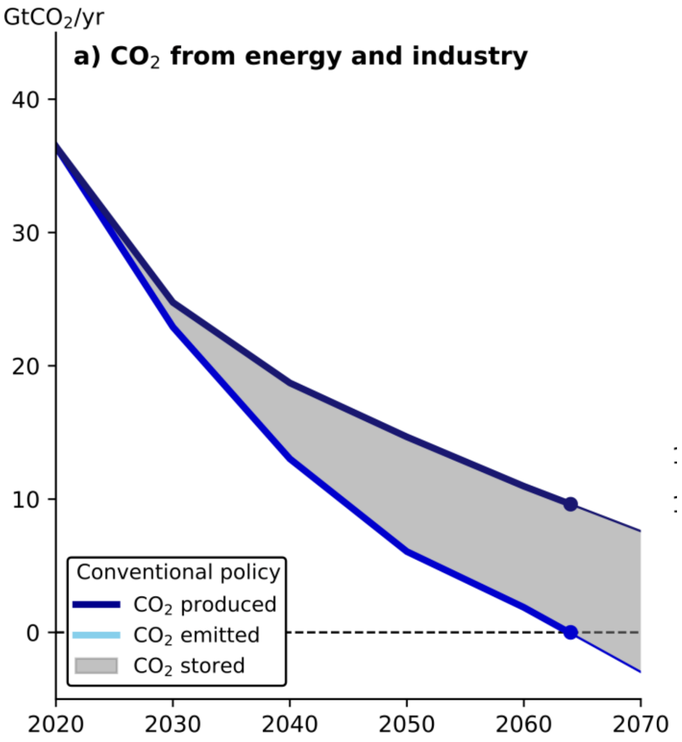
https://www.goldmansachs.com/insights/pages/gs-research/carbonomics-10-key-themes-from-the-inaugural-conference-f/report.pdf

Low-cost opportunities in nature-based climate solutions – but trees take time to grow



And are vulnerable to warming itself

To stop fossil fuels from causing global warming we need to store 1 tCO_2 for every 1 tCO_2 still produced



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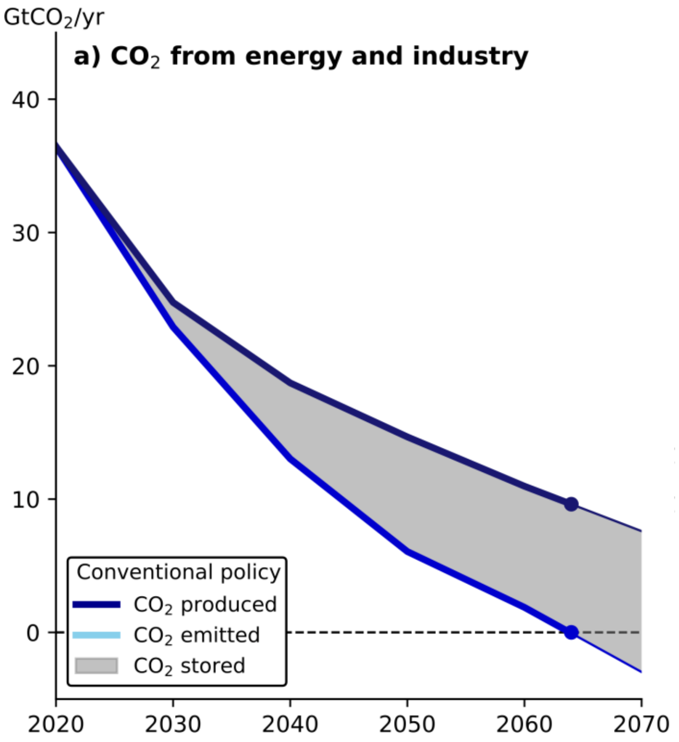

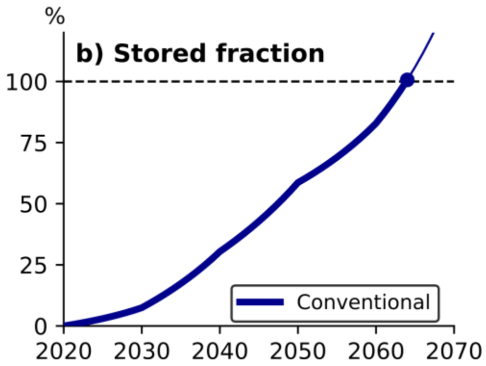

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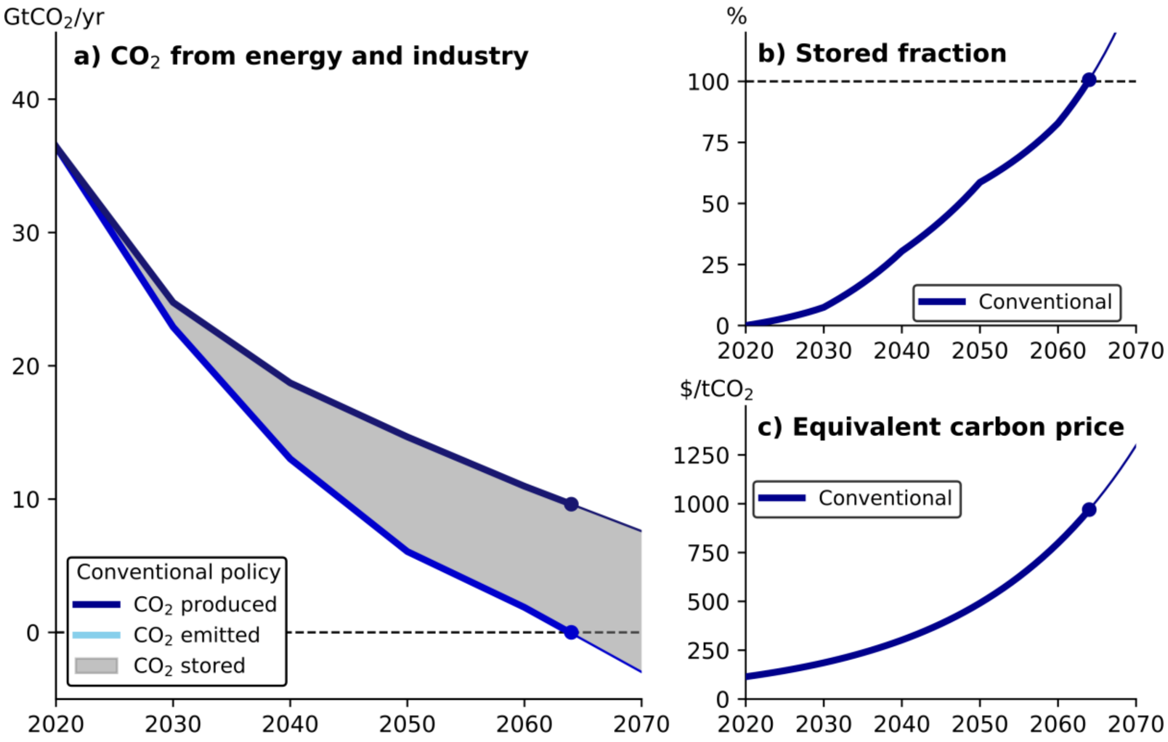
Achieving Net Zero in conventional IAMs requires carbon prices rising exponentially to >$1000/tCO$_2$

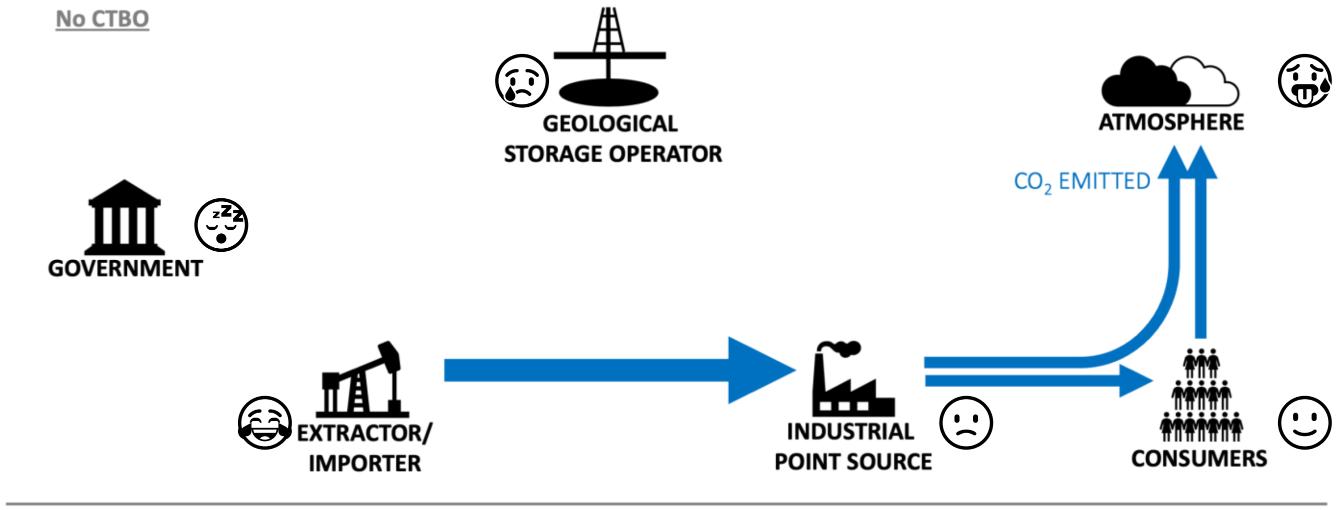


Reason prices exceed DAC costs: models assume we don't build DAC fast enough.

A hypothetical global Carbon Takeback Obligation

- A group of countries (or buyers' cartel?) requires anyone selling fossil fuels to certify that a rising fraction of the CO_2 generated by those fuels has been geologically sequestered.
- Sequestered CO_2 can be sourced from any CO_2 that would otherwise have ended up in the atmosphere.
  - Companies would initially capture their own (e.g. refinery) emissions, then industrial sources, and eventually free air capture.
- This sequestered fraction rises, on average, by 3.3% per year, but slower initially: 10% by 2030, 50% by 2040, 100% by 2050.

How a Carbon Takeback Obligation works



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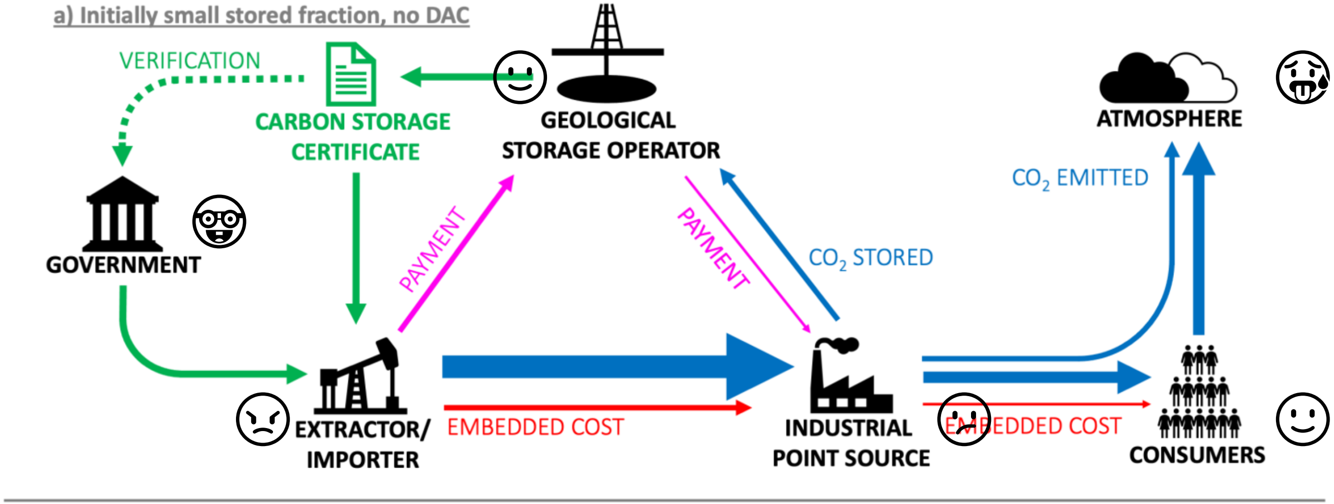

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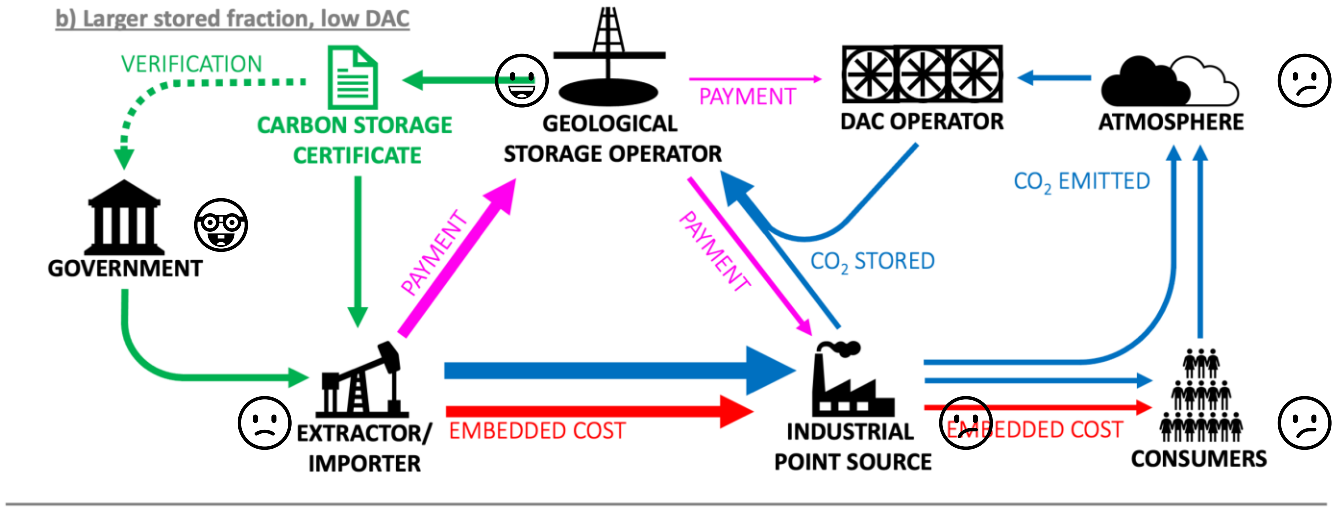

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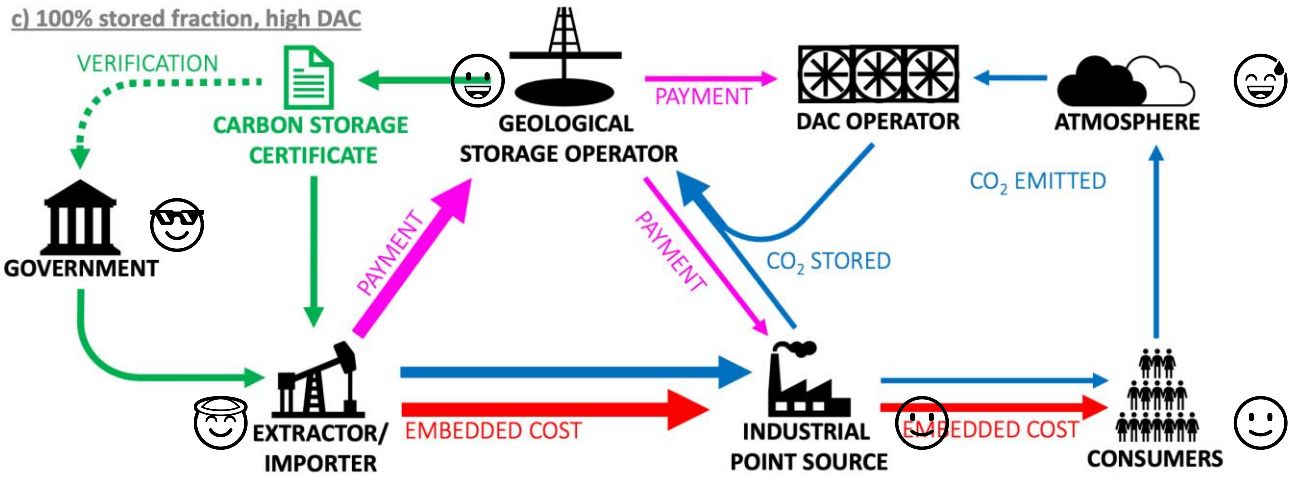


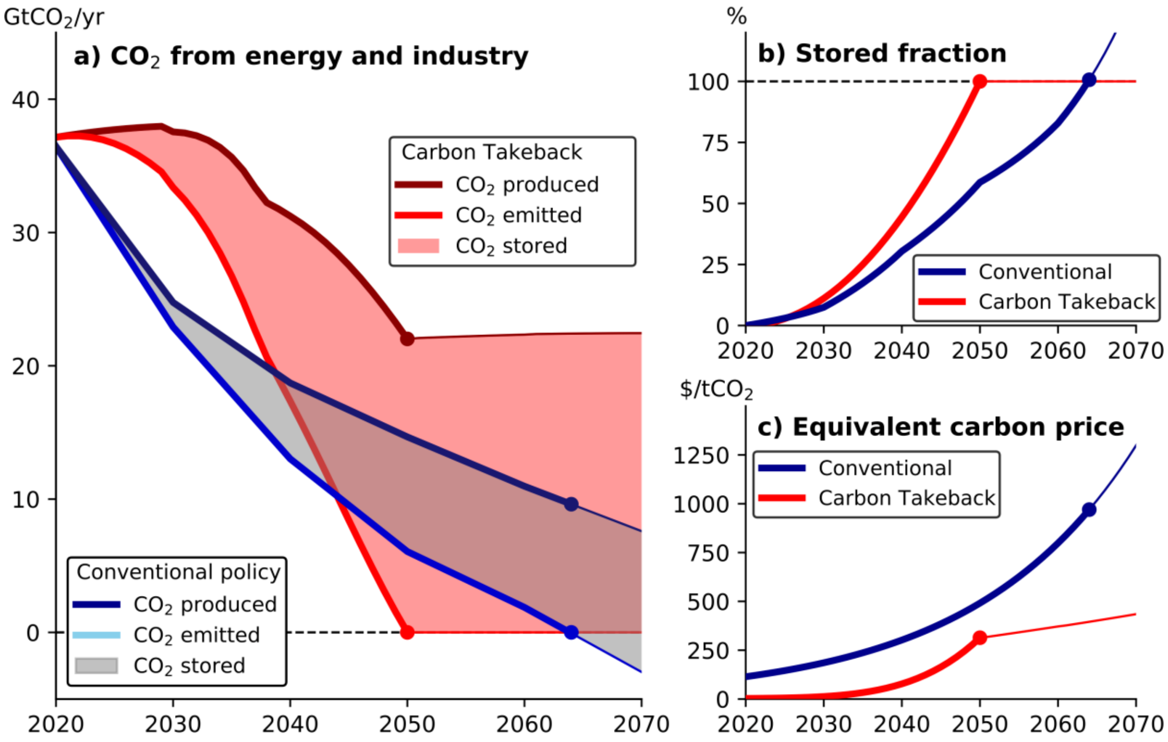
- Actual or embedded CO_2
- Regulation and compliance
- CTBO compliance costs
- Payments for GCS

Weight of arrow reflects relative size of cost and CO_2 flow.
The relative size of CO_2 flows depends on many factors, including the CTBO's stored fraction, availability of industrial point source CCS and availability of DAC technologies.

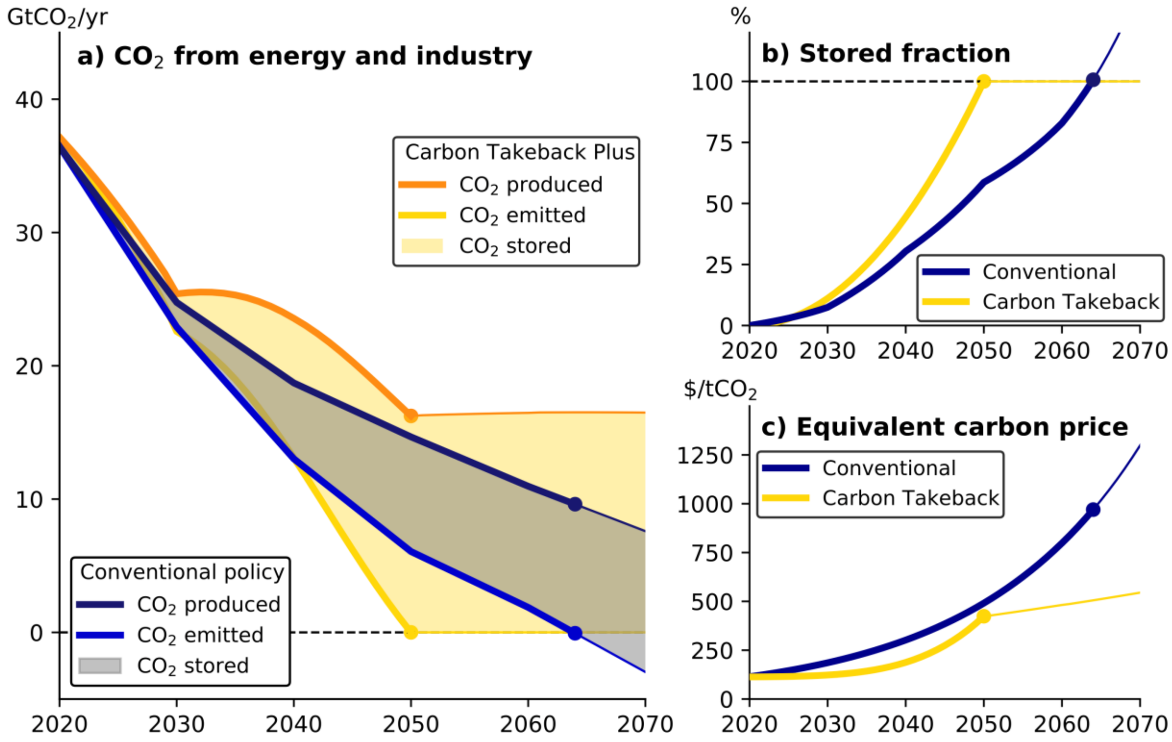
The surprising economics of Carbon Takeback

- Suppose CO_2 disposal costs
  - \$50/tCO_2 *sequestered* initially (CO_2 captured at source),
  - \$300/tCO_2 at net zero (point sources + direct air capture).
- Cost per tCO_2 of fossil carbon *sold* = $S(50+250S)$ where S is sequestered fraction.
- This is equivalent to a *consumer* carbon price of:
  - \$ 0.52 /tCO_2 at S=1% (early 2020s)
  - \$ 7.50 /tCO_2 at S=10% (2030)
  - \$300 /tCO_2 at S=100% (2050)

The problem with Carbon Takeback: it's too cheap! (initially)



Supplementing a Carbon Takeback Obligation with modest demand management



The main take-home:

- Introducing a CTBO now reduces the risk of:
  - non-economic constraints delaying CCS deployment,
  - prohibitively high carbon prices being needed to achieve net zero, and
  - consequent failure to meet climate goals.
- An upstream regulatory measure to decarbonize fossil fuels by 2050 is an essential backstop to demand-side measures.
- If implemented alongside demand-side measures, it could meet Paris climate goals at no significant additional cost.

For more information

https://carbontakeback.org