



Emissions accounting for CO₂-EOR

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What we often hear about CO₂-EOR

The good

- It's a “win-win” solution for the climate
- It can offset the costs of CCS
- It can lead to long-term emission reductions
- It substitutes other sources of potentially more emission intensive oil supply

The bad

- It uses climate finance to encourage more fossil fuel production
- It diverts these resources away from renewables
- It can never reduce emissions as it produces more oil

How can we address these questions?

- Greenhouse gas emission accounting
 - Provides an objective basis for measuring **net** CO₂ emission reductions arising from operations
- Accounting issues for EOR:
 - Site level emissions
 - Subsurface monitoring
 - Incrementally produced crude oil

How can we account?

Life cycle analysis

- *Ex ante* estimate of full chain emissions
- Usually based on scenarios and estimates
- Boundaries and assumptions are critical factors
- Rubbish in, rubbish out

Both approaches are relevant:

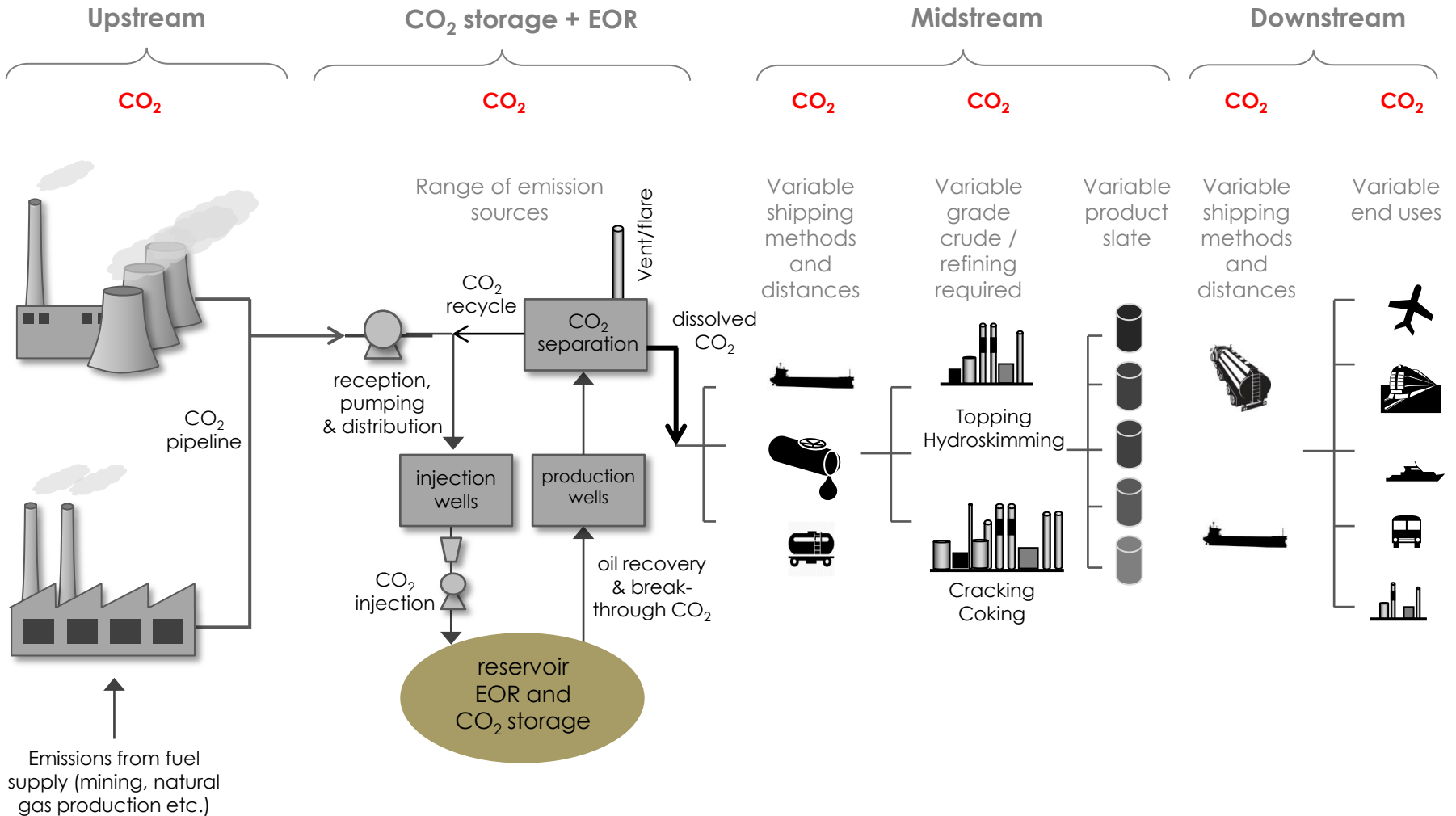
- LCA can reveal whether CO₂-EOR delivers net emission reductions, and therefore validity as an emission reduction technology
- Can be useful for e.g. EIA of projects

Measurement, reporting and verification (MRV or MMV)

- *Ex post* measurement of emissions
- Based on performance of actual operations
- Boundaries and measurement approach determined by scheme rules

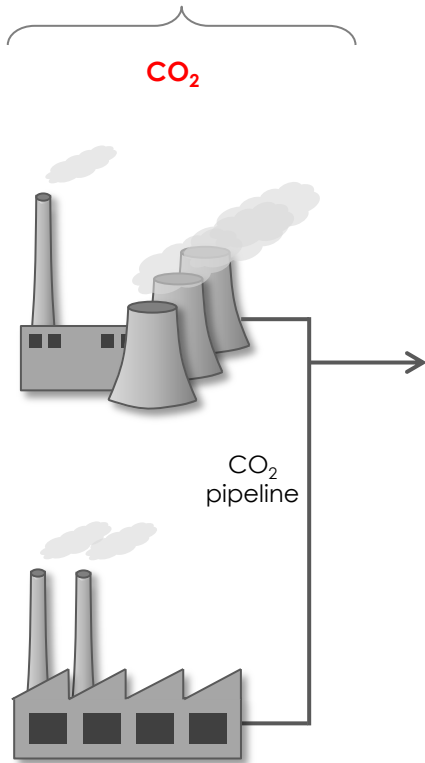
- MRV provides guidance and rules in order to measure effectiveness of GHG policies and targets
- Essential part of carbon price incentives e.g. C-Tax or ETSs

What needs to be measured?



Upstream emissions/reductions

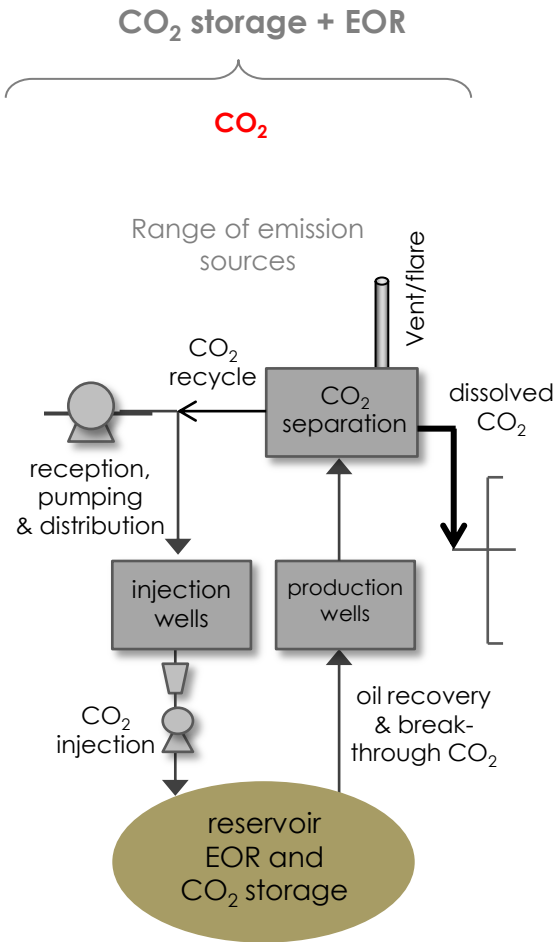
Upstream (CO₂ capture)



- Most GHG regulations allow captured and exported CO₂ to be deducted from facility GHG inventory (e.g. IPCC, EU ETS, GHGRP etc.)
- Provides the basis for carbon price incentives for CCS and CO₂-EOR

NO ISSUES HERE

Site-level emissions



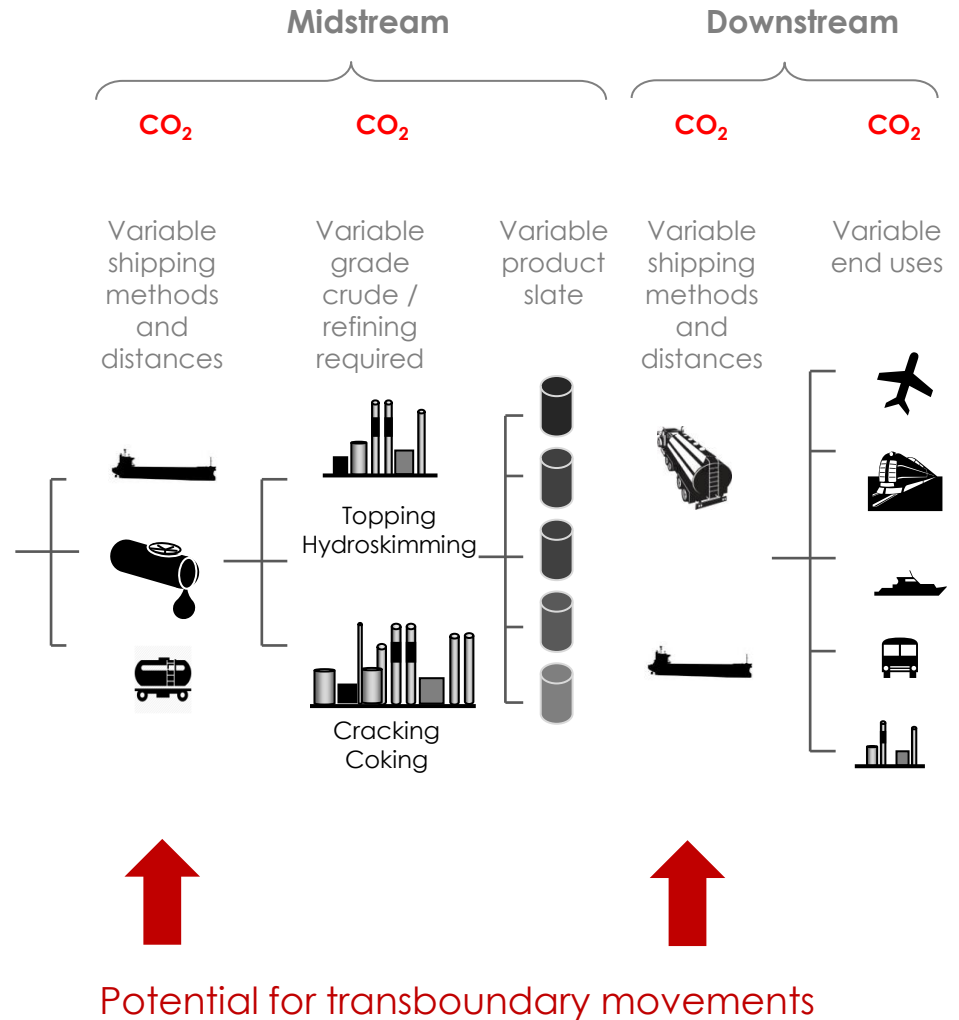
- All GHG policies supporting CCS require monitoring of storage site emissions (e.g. IPCC, EU ETS, GHGRP etc.). Including CO₂-EOR:
 - Surface energy use
 - Vents, flares and other fugitives
 - Reservoir seepage monitoring
- Emissions added to overall CCS inventory to give **net** reductions within scheme boundary

NO ISSUES HERE

Mid- and downstream emissions

- These emissions may or may not fall within scheme boundary
- Depends on movement of crude oil across borders → **Emissions Leakage**

ISSUES HERE

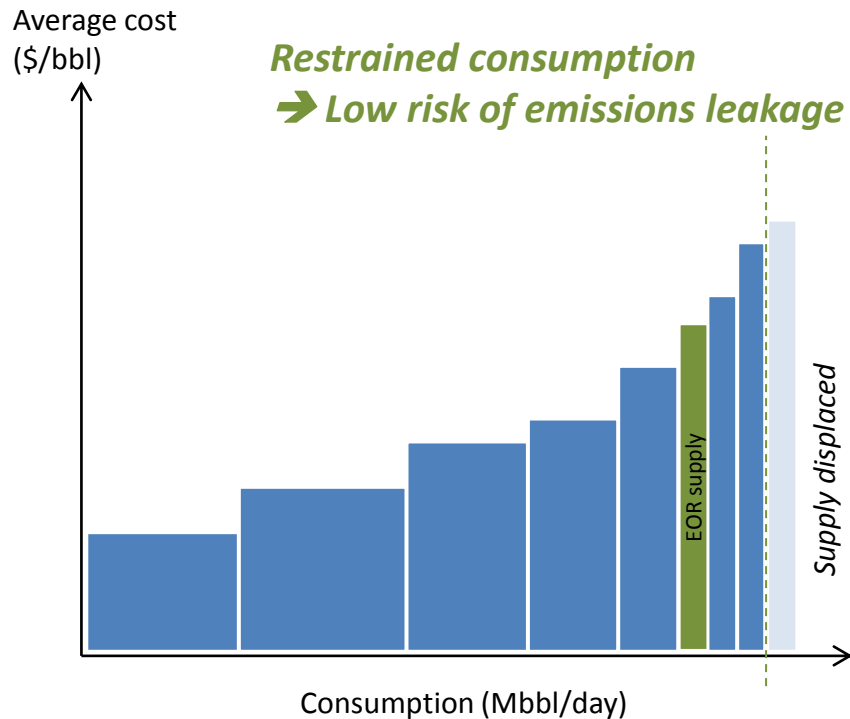


Emissions leakage

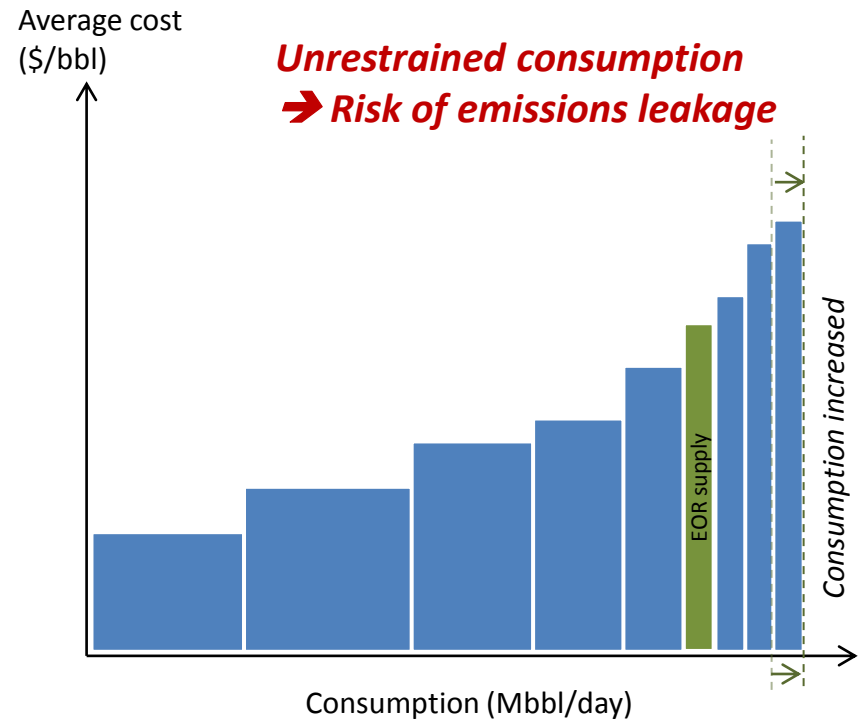
- Defined as:
 - *“potential for net changes in emissions to occur outside the boundaries and operational control of a particular policy and/or activity, but arising as a consequence of the policy and/or activity”*
- Scope to affect environmental integrity of scheme incentivising CO₂ storage via EOR
- Risk where asymmetry in GHG policies and measures (PAMs) between
 - (a) where capture and EOR occurs; and
 - (b) where crude is refined and used

Nature of leakage risk

Substitution



Addition



GHG PAMs can indicate risk of leakage

Low risk

- Refining subject to emission controls e.g. EU ETS, GHGRP
- End-use subject to constraints e.g.
 - Portfolio standards for vehicles
 - Portfolio standards for fuel suppliers
 - Aviation sector controls

→ Substitution

High risk

- Weak policies and/ or no controls in place
- Scope for unconstrained increase in fossil fuel use
- Subsidies on fossil fuel consumption can actually encourage growth

→ Addition

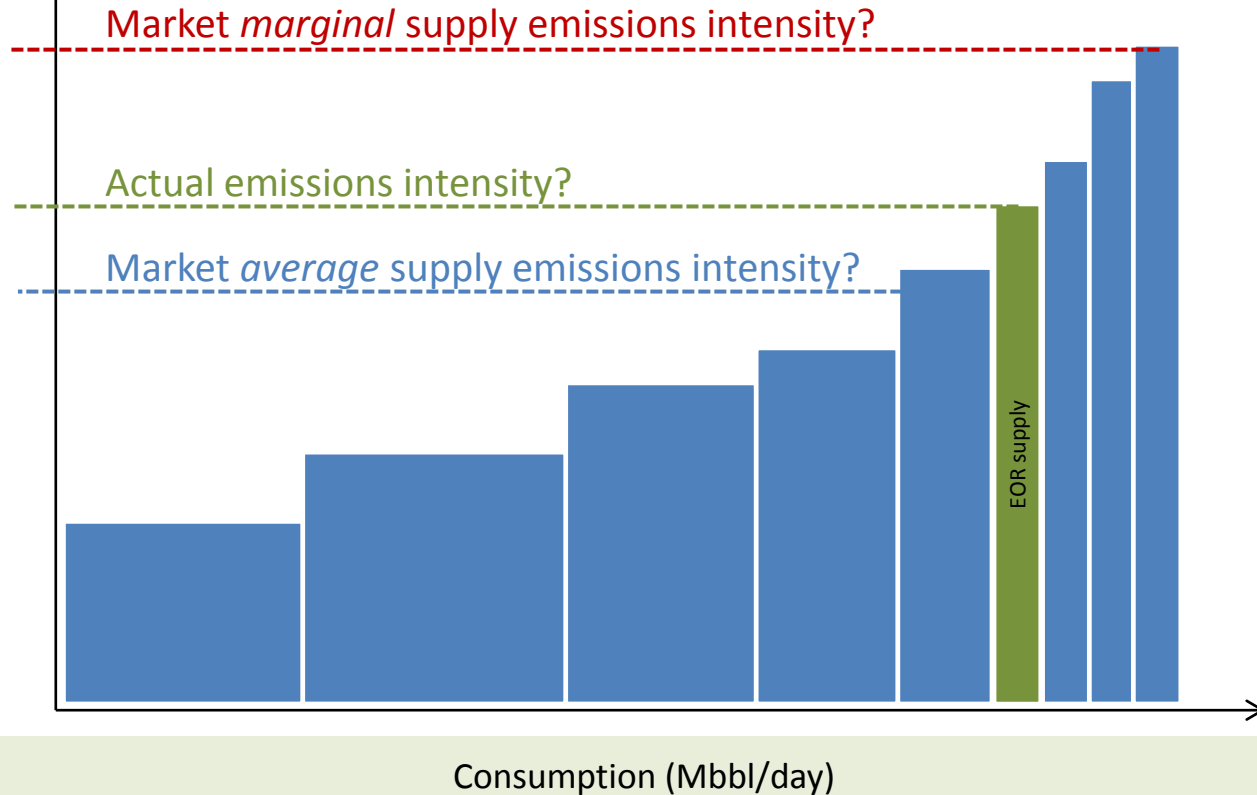
But not the perfect measure of risk

- Wide range of other factors at play:
 - Oil price dynamics
 - Subsidies on production and consumption
 - Political interventions e.g. quotas, etc.
- Variations in stringency of GHG PAMs:
 - Variation in Kyoto Protocol and INDC “targets”
 - Variations in national PAMs e.g.
 - EU vehicle std: 130 gCO₂/km (2014) → 95/gCO₂ km (2020)
 - US vehicle std: 140 gCO₂/km (2016) → 113/gCO₂ km (2020)

Leakage effect also difficult to measure

Average emissions
(tCO₂/bbl)

Many factors to consider in
selecting the appropriate measure





Discussion of these issues forthcoming in IEA GHG report:

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