Emissions accounting for CO$_2$-EOR

Paul Zakkour
Carbon Counts
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What we often hear about CO$_2$-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 CO$_2$ 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

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

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

- 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**
- CO₂

**CO₂ storage + EOR**
- CO₂
- Range of emission sources
- CO₂ recycle
- injection wells
- production wells
- oil recovery & breakthrough CO₂

**Midstream**
- Variable shipping methods and distances
- Variable grade crude / refining required
- Variable product slate
- Variable shipping methods and distances

**Downstream**
- Variable end uses

Emissions from fuel supply (mining, natural gas production etc.)
Upstream emissions/reductions

- Most GHG regulations allow captured and exported CO$_2$ to be deducted from facility GHG inventory (e.g. IPCC, EU ETS, GHGRP etc.)
- Provides the basis for carbon price incentives for CCS and CO$_2$-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 CO$_2$-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**

*Restrained consumption ➔ Low risk of emissions leakage*

**Addition**

*Unrestrained consumption ➔ Risk of emissions leakage*
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

Many factors to consider in selecting the appropriate measure

- Market marginal supply emissions intensity?
- Actual emissions intensity?
- Market average supply emissions intensity?
Discussion of these issues forthcoming in IEA GHG report:

Paul Zakkour
Director, Carbon Counts
E: paul.zakkour@carbon-counts.com
W: www.carbon-counts.com
T: +44 20 8870 3330 / +44 20 3603 8146 / +44 7834 161016