Methodology for CCS in the CDM

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Overview

• Key issues for a methodology
  • Applicability
  • Project Boundary
  • Leakage
  • Baseline
  • Accounting & monitoring: above ground, below ground
  • The Environmental Impact Assessment (EIA)
Applicability

- Desire to develop methodology with ranging applicability criteria *inter alia*:
  - Power plants (gas, coal (PF-SC/USC)
  - Gas processing (offshore, onshore, LNG knockout)
  - Synfuels
  - Other major point sources (refineries, cement etc.)
  - Transport (pipeline, tanker)
  - Storage (saline formations, O&G resrvr’s, EOR)
Applicability (and baseline scenarios)

Capture

Power plant (gas turbine, gas boiler, PF-SC/USC, IGCC etc)
- Retrofit
- New-build
  - “end-of-pipe”
  - integrated

Industrial installation (NG sweetening, LNG, synfuels, cement, iron&steel etc.)
- Retrofit
- New-build
  - “end-of-pipe”
  - integrated
Applicability - Precedents in CDM

• ACM0002 – Grid connected renewables
  • Applicability: not applicable to renewables switching from fossil fuels, since the baseline may be the continued use of fossil fuels at the site

• ACM0009 – Fuel switch in industrial installation
  • Applicability: switch from coal or petroleum fuels to gas. No capacity extension to power or plant output

• AM0029 – Natural gas grid connected power
  • Applicability: new gas fired power plants only

• Need to define new applicability conditions based on system presented previously. Must carefully consider reasons for certain clauses in applicability criteria to ensure consistency with CDM precedents
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Project boundary (& leakage)

• All elements of the CCS chain to be included

Input fuel

CO$_2$ generation (*industrial installation*)

Capture plant

Treatment

Compression facility

Injection facility

Reception facility

Transportation

Booster

Storage site

Well(s)

Surrounding area (*lateral and vertical adjacent regions*)

Enhanced hydrocarbon recovery

Hydrocarbon fuel combustion

PROJECT BOUNDARY
Leakage - EOR

No further activity (NFA; primary & secondary depletion)
Enhanced oil recovery

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Baseline - introduction

• **Baseline [scenario] is…**
  
  ...the scenario which reasonably represents anthropogenic emission that would occur in the absence of the project

• **Three types of baseline approaches (para 48, MA)**
  1. Existing actual or historical emissions, as applicable;
  2. Emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment;
  3. The average emissions of similar project activities undertaken in the previous five years, in similar social, economic, environmental and technological circumstances, and whose performance is among the top 20 per cent of their category.
Issues for the baseline

**New build (greenfield) power plants**
- Choice of fuel (coal v gas)
- Consider plant type choice (IGCC v PF etc)
- *Build margin* versus *operating margin* (for grid connected power)
- *<Renewables only get combined margin>*

**Retrofit or ‘pure’ streams**
- More straightforward
- Simply emissions without CCS (?)
- Consider bans on venting
- Impurities e.g. H2S

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Baseline – retrofit issues

1 GW<sub>e</sub> coal plant

<table>
<thead>
<tr>
<th>Baseline (historical) emissions</th>
<th>“End-of-pipe” retrofit</th>
<th>Integrated retrofit with a capacity extension</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 MtCO₂ / yr</td>
<td>10 MtCO₂ / yr</td>
<td>11 MtCO₂ / yr</td>
</tr>
<tr>
<td>7000 GWh&lt;sub&gt;e&lt;/sub&gt;</td>
<td>5900 GWh&lt;sub&gt;e&lt;/sub&gt;</td>
<td>7000 GWh&lt;sub&gt;e&lt;/sub&gt;</td>
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</table>

• Further issues:
  • for an integrated retrofit, is there capture from the capture plant?
  • For power plants, baseline calculation should be based on electrical output. More challenging for industrial installations, esp where there is little experience worldwide (e.g. synfuels)
Baselines – precedents in CDM

- ACM0002 – Grid connected renewables
  - Baseline: *uses the combined margin*. Could be applicable for new builds (note applicability excludes situations where replacing existing fossil plant [i.e. retrofit] as the baseline is historical emissions)

- ACM0009 – Fuel switch in industrial installation
  - Baseline: *includes the CO₂ emissions from the combustion of the quantity of coal or petroleum fuel that would be used in each element process in absence of the project*

- AM0029 – Natural gas grid connected power
  - Baseline: *derived by multiplying the electrical output of the new plant with the EF of the baseline plant*

- **Need to think carefully as to how to apply different baseline approaches / methodology for each CCS application outlined in the applicability criteria**
Accounting, M&R – above ground

• Need to develop algorithms etc which can account for all emissions across the CCS chain
  • Fugitive emissions: leaking pipelines, valves etc
  • Indirect emissions: additional power requirements for capture, transportation, injection (energy penalty, booster stations etc.)

• Need to ensure account for *emission avoided*, not emissions *captured* or *stored*

• *Does not present any major new issues (except the power piece), and can be drawn from existing methodologies*
Accounting, M&R – below ground

• CDM Methodology: monitoring plan to collect data for accounting

• Below ground parts: IPCC 2006 forms important basis
  • IPCC range of techniques – “shopping” list
  • Should not be overly prescriptive on techniques
  • Should be risk-based and subject to validation

• Monitor storage site for seepage because:
  • During crediting period = \textit{project emissions}
  • Beyond crediting period = \textit{permanence problem}
M&R Below ground - key steps & documentation

Step | Documentation
---|---
1. Literature & data review | Data catalogue (geology, geophysics, old wells, other uses) QA/QC
2. Build static Earth model | Agreed / qualified / verified set of static Earth models inc. rational behind decisions / choices – define project boundary QA/QC
3. Dynamic Earth model | Source sink matching; injection plan; numerical simulations; plume behaviour; ultimate fate; trapping mechs; flux rates across boundary, secondary containments; seepage pathway; hydro-geology; biosphere QA/QC
4. Define EIA (risk-based) | EIA; environmental baseline QA/QC
5. Define monitoring scheme | CDM PDD monitoring methodology QA/QC
The role of the EIA

• EIA will need to include:
  • Environmental baseline study around storage site
  • Full carbon balance for the project
  • Assessment of sources – pathways - receptors
  • Remediation commitment & plan
  • Liability arrangements + stewardship/handover
  • Make up any emitted CERs (until liability transfer)
  • Insurance could be an important component

• Could be bound by set of guiding principles by EB
• Should be subject to validation by DOE
• May create capacity building requirements in dev countries
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Thank you

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