

UK work on CCS and the EU Emissions Trading Scheme

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Abstract

The EU Emissions Trading Scheme (ETS) is the main market-based instrument aimed at reducing greenhouse gas emissions across the EU. The UK DTI is taking the initiative to ensure that Carbon dioxide Capture and Storage (CCS) can earn emission credits in the EU ETS.

The DTI called together a group of 20 experts from across the EU with the objective of understanding how CCS can comply with the EU ETS, and to produce suggested guidelines for monitoring and reporting. On behalf of this group DTI commissioned a study to examine the issues, undertaken by ERM and DNV.

The study considered the options and proposed a method to account for CO₂ emissions reductions arising from CCS in a complete, consistent, transparent, accurate and relevant manner consistent with the existing EU ETS regulatory framework. While the EU ETS is based upon emissions only within installation boundaries, the proposed approach involves the reconciliation of fugitive emissions across the CCS chain up to and including the point of geological injection (ie outside the installation boundaries) in order to maintain the environmental integrity of the EU ETS.

As storage involves longer timescales and different regimes to those in the EU ETS's annual accounting, the study proposed that any seepage emissions from geological storage should be handled through the appropriate storage site licensing and permitting regimes within Member States' regulations. Suggestions are made as to how any storage site seepage to atmosphere may be effectively regulated in order to maintain the environmental integrity of the EU ETS. These conclusions were then used to produce a recommendation for outline monitoring and reporting guidelines, including requirements for the permitting and regulation of storage sites.

The recommendations and outline guidelines have been presented to the European Commission (EC) to inform its work on CCS in the EU ETS.

The EU ETS

The EU ETS is the main market-based instrument for the reduction of greenhouse gas emissions across the EU. The EU ETS commenced on 1 January 2005 and is the first international scheme of its kind to operate. Under this scheme, installations which are large emitters of CO₂ will have a 'cap' of emission allowances and the ability to trade these allowances.

The EC produced guidelines for monitoring and reporting of greenhouse gas emissions from installations included under the EU ETS Directive in early 2004. Decision C(2004) 130 Final of 29 January 2004 *establishing guidelines for the monitoring and reporting of greenhouse gas emissions*

pursuant to the Directive 2003/87/EC of the European Parliament and Council ('Decision C(2004)130') sets out the methodologies installations should apply when calculating their annual emissions of greenhouse gases. It outlines a mixture of *calculation-* and *measurement-*based methodologies, and sets out varying levels of rigour, based on the materiality of total annual CO₂ emissions from the installation. Decision C(2004)130 does not include any specific guidelines for monitoring and reporting greenhouse gas emissions from CCS. However, under Section 4.2.2.1.3 of the Decision, the Commission says that: *Member States interested in the development of such guidelines are invited to submit their research findings to the Commission in order to promote the timely adoption of such guidelines* (see Box below).

EU Group of Experts

The UK Government recognises the important role that CCS can play in reducing greenhouse gas emissions and the opportunities for the UK, and hence is keen to see the environmental benefits of CCS rewarded by market-based incentives. Following the EU Decision, the DTI therefore called together a group of 20 EU experts with the objective of understanding how CCS can comply with the EU ETS, and to produce suggested guidelines for monitoring and reporting. The members of this "Ad Hoc Group of EU Experts on Monitoring and Reporting for CCS in the EU ETS" come from expert consultants with knowledge in emissions verification, academia, industry, EU governments, European Commission DG Environment and DG Research. This group has met five times since its formation in April 2004. On behalf of this group DTI commissioned a study to examine the issues, to be undertaken by ERM and DNV and guided and peer reviewed by the group.

More specific guidance in relation to CCS is given under Section 4.2.2.1.3:

The Commission is stimulating research into the capture and storage of CO₂. This research will be important for the development and adoption of guidelines on the monitoring and reporting of CO₂ capture and storage, where covered under the Directive, in accordance with the procedure referred to in Article 23(2) of the Directive. Such guidelines will take into account the methodologies developed under the UNFCCC. Member States interested in the development of such guidelines are invited to submit their research findings to the Commission in order to promote the timely adoption of such guidelines.

Before such guidelines are adopted, Member States may submit to the Commission interim guidelines for the monitoring and reporting of the capture and storage of CO₂ where covered under the Directive. Subject to the approval of the Commission, in accordance with the procedures referred to in Article 23(2) of the Directive, the capture and storage of CO₂ may be subtracted from the calculated level of emissions from installations covered under the Directive in accordance with those interim guidelines.



A DTI INITIATIVE

Study by ERM and DNV

The study considered the options and proposed a method to account for CO₂ emissions reductions arising from CCS in a complete, consistent, transparent, accurate and relevant manner consistent with the existing EU ETS regulatory framework. The EU group of experts guided and peer-reviewed this study. While the EU ETS is based on emissions only within installation boundaries, the study proposed an approach involving the reconciliation of fugitive emissions across the CCS chain up to and including the point of geological injection (ie outside the installation boundaries) in order to maintain the environmental integrity of the EU ETS.

All emissions trading schemes require some form of reconciliation, in other words a process whereby the emissions reductions attached to a project, or an installation's emissions allowances, are checked off against the actual emissions arising from the activity over a given time period.

Under the EU ETS, CO₂ emissions from an installation over a calendar year should be reconciled *ex post* in the following calendar year, by 31 March, in line with the appropriate monitoring, reporting and verification requirements laid down in the EU ETS Directive (*Articles 14 and 15*). The result of this reconciliation process will determine the total number of European Union Emissions Allowances (EUAs) that an installation must surrender to a competent authority in a Member State.

Installations under the EU ETS which use CCS will claim that the tonnes of CO₂ they have delivered to a CCS facility were not emitted in the calendar year during which they were exported. Thus, the sum of EUAs which the installation must surrender for compliance under the EU ETS will be reduced by the amount of tonnes of CO₂ sent to CCS. However, it will be necessary to reconcile the tonnes of CO₂ that an installation can claim via CCS with any CO₂ leakage that might occur during the transfer of CO₂ from the installation to a CCS facility, subject to *ex-post* verification.

Liability in this context refers only to the assigning of responsibilities for monitoring and reporting of CO₂ emissions across a CCS chain. Associated with this will be the debiting of physical CO₂ leakage against the amount of emissions reductions attributable to an exporting installation, or the amount of emissions allowances that must be surrendered by an installation under a cap and trade scheme (or 'reconciliation').

During this work, the default assumption was that CCS chains would evolve through the engagement of several contracting parties each responsible for capturing, transporting and storing CO₂: capture by the installation operator; transportation by another party commercially motivated to operate pipeline networks, and storage again by a different party, who are likely to be oil & gas companies in the early stages of CCS.

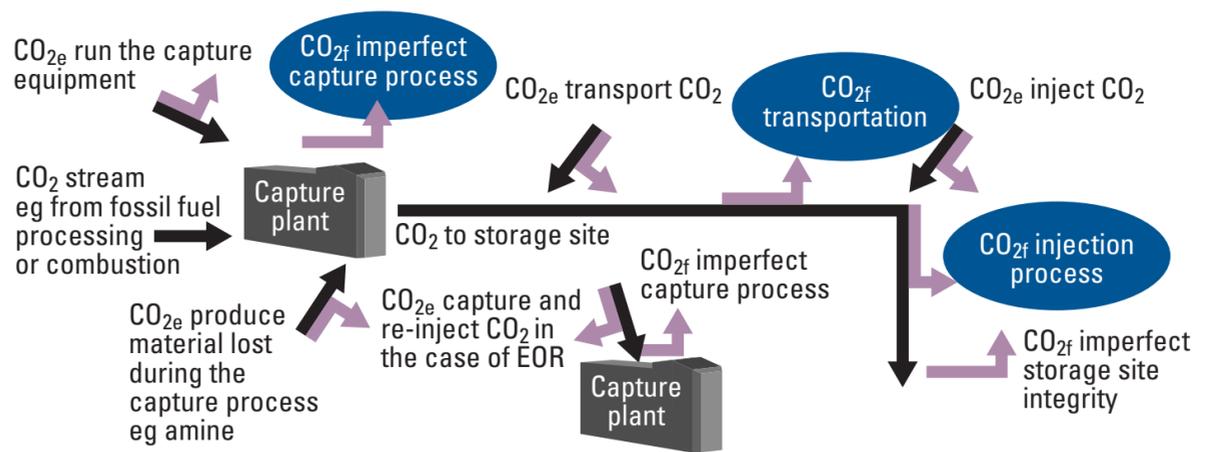
Treatment of Storage Sites

In order to account for any *potential* future emissions of the stored CO₂ back to the atmosphere, some observers have suggested that any emissions reductions credit given to project or installation operators employing CCS should be subject to some form of discounting. Alternatively, it has also been suggested that default factors could be developed and applied that assume a standard rate of leakage. However, these approaches are considered to present a number of problems in that:

- (i) they assume that the storage site *will* leak over a set timeframe
- (ii) this timeframe, and the flux rate can be established *ex ante* based on detailed understanding of the storage reservoir characteristics and the behaviour of the sub-surface stored CO₂
- (iii) potentially the discount factor applied could be so small as to have little relevance when converted back to a tCO₂/yr basis (ie less than 1 tonne CO₂ or 1 EUA per year)
- (iv) the point in time at which any leakage might occur may not be relevant to any institutional structures and arrangements that currently exist
- (v) it is unclear upon which basis appropriate discount rates or default factors could be selected.

CO_{2e} = CO₂ to atmosphere due to energy used to ...

CO_{2f} = fugitive CO₂ from ...



Emissions sources across a CCS chain (summarised by Haefeli et al 2003)

Therefore, for the monitoring and reporting framework methodology for CCS under the EU ETS it has been proposed that CO₂ emissions from storage sites be excluded from an installation's inventory.

However, storage sites would need to be controlled under an appropriate regulatory regime. This is not in place yet in the EU Member States. Some considerations for storage site permitting and licensing are as follows:

- (i) The storage site operator would be required to show appropriate due diligence during storage site selection, such that all the available geological survey data and other evidence regarding the security of gas storage in the reservoir suggest, within reasonable expectation, that the reservoir would not leak.
- (ii) In the event of any short-term leakage, an emergency plan was in place to minimise losses.
- (iii) Storage site operators would be required to make a commitment to monitor and report quantified emissions of CO₂ leaking, by seepage or sudden release from the site, using good practice techniques likely to evolve over time.
- (iv) These losses would need to be reported to the host government, who would then take them into account in their National Greenhouse Gas Inventories under the UNFCCC.
- (v) That operating licences would be time-limited and subject to renewal/approval on the grounds that the storage site was operating satisfactorily (ie not leaking at an unacceptable rate).
- (vi) The requirement to monitor and report leakage by seepage or sudden release would be ongoing after the sealing of the injection wells and closing of the site. Ultimately, this responsibility would fall to the government under whose territory the CO₂ is being stored, ie the host government would make a long-term commitment to take responsibility for the stewardship of a storage site, including emissions monitoring and measurement, and also in the event of insolvency of the site operator, or licence withdrawal or expiry.

Recommendations

It is proposed that in order to maintain the environmental integrity of a cap and trade scheme such as the EU ETS, fugitive emissions occurring outside the installation boundaries should be reconciled with the estimated quantity of CO₂ transferred at the installation's CO₂ export point, within the annual timeframe of the EU ETS reconciliation process.

This requirement is particularly pertinent in the case of the EU ETS because:

- (i) pipelines are not listed as 'installations' under the EU ETS, and therefore have no direct regulatory or financial incentive to limit CO₂ emissions
- (ii) geological storage sites also are not 'installations' *per se* (although many offshore platforms are included as installations under the EU ETS, and thus venting of breakthrough CO₂ in EOR activities could be apportioned to their allowance allocation/level of allowance surrender required for compliance).

Therefore, for the purposes of reconciliation, a methodology must be developed for calculating those emissions, and apportioning them back to the exporting installation(s).

Consequently, the following boundary and completeness criteria are considered to be appropriate for CCS under the EU ETS:

- (i) all CO₂ produced at each installation should be calculated according to existing guidelines for that installation as outlined in Decision C(2004)130
- (ii) energy used for powering the CO₂ capture equipment and for initial pipeline compression at the installation (the 'energy penalty') will be incorporated into the net calculation for each installation of (i)
- (iii) any fugitive CO₂ emissions occurring at each installation through inefficiencies in the capture process ie any stack emissions of CO₂, should be reported and reconciled with (i)
- (iv) any fugitive emissions arising from transport of the CO₂ to the storage site, either through background leakage, pipeline venting, blowdown or accidental release should be reported and reconciled with (i)
- (v) any fugitive emissions occurring during injection at the storage site injection head should be reported and reconciled with (i)
- (vi) any fugitive emissions occurring from the storage site - post injection - need not be reconciled with (i).

While other CO₂ emissions sources could be directly linked to a CCS chain, these should be specifically *excluded* from the proposed methodology, including the following:

- Indirect CO₂ emissions associated with the energy used to power capture equipment and pipeline head compression - the 'energy penalty' (these will be included under (i) above).

- Indirect CO₂ emissions associated with energy used in compression or cooling of CO₂ during transport and injection.
- Indirect CO₂ emissions associated with the energy used in manufacture of CO₂ stripping agents.
- Any long-term seepage of CO₂ from geological storage reservoirs.
- Other forms of physical leakage occurring at the storage site (eg accidental emissions resulting from reservoir monitoring).

These conclusions were used to produce a recommendation for outline monitoring and reporting guidelines, including requirements for the permitting and regulation of storage sites.

The report and outline guidelines have now been presented to the EC, and will inform its progress on CCS and the EU ETS. The reports are available on the DTI Web site.

For more information please see the following: on the EU ETS CCS study report - the DTI Web site www.dti.gov.uk/energy/coal/cfft/; on the EU ETS – the Defra Web site www.defra.gov.uk/environment/climatechange/trading/eu/; and on the IPCC – www.ipcc.ch.

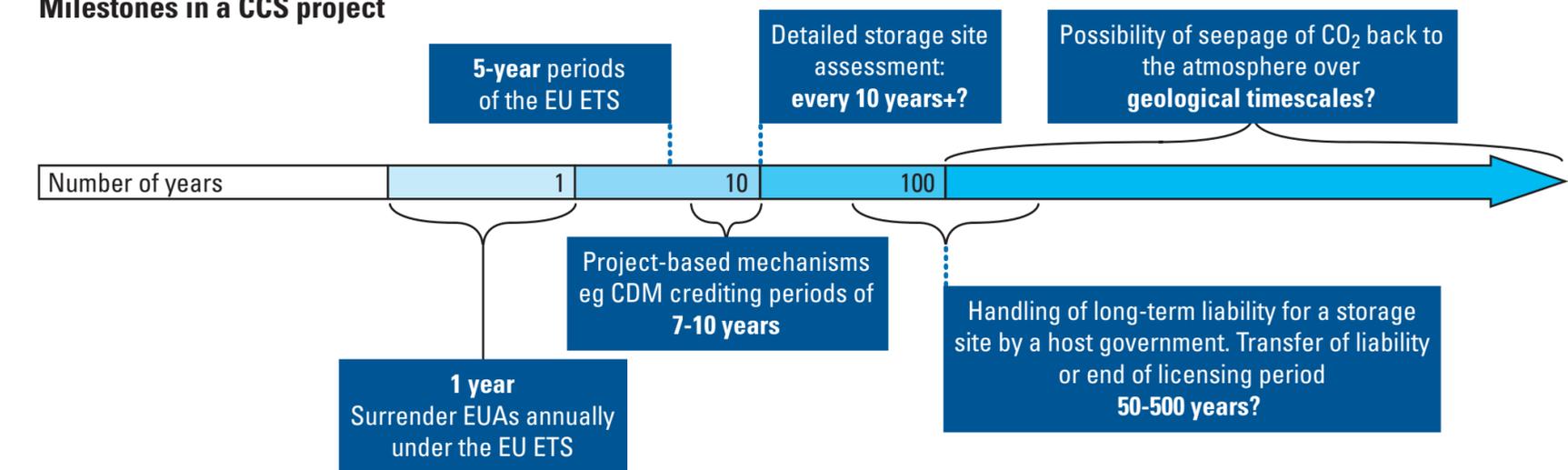
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Developing Monitoring, Reporting and Verification Guidelines for CO₂ Capture and Storage under the EU ETS. Dr P Zakkour, C Girardin, L Solsbery, S Haefeli, P Murphy. Jan 2005. Report Coal R277 DTI/Pub URN 05/583

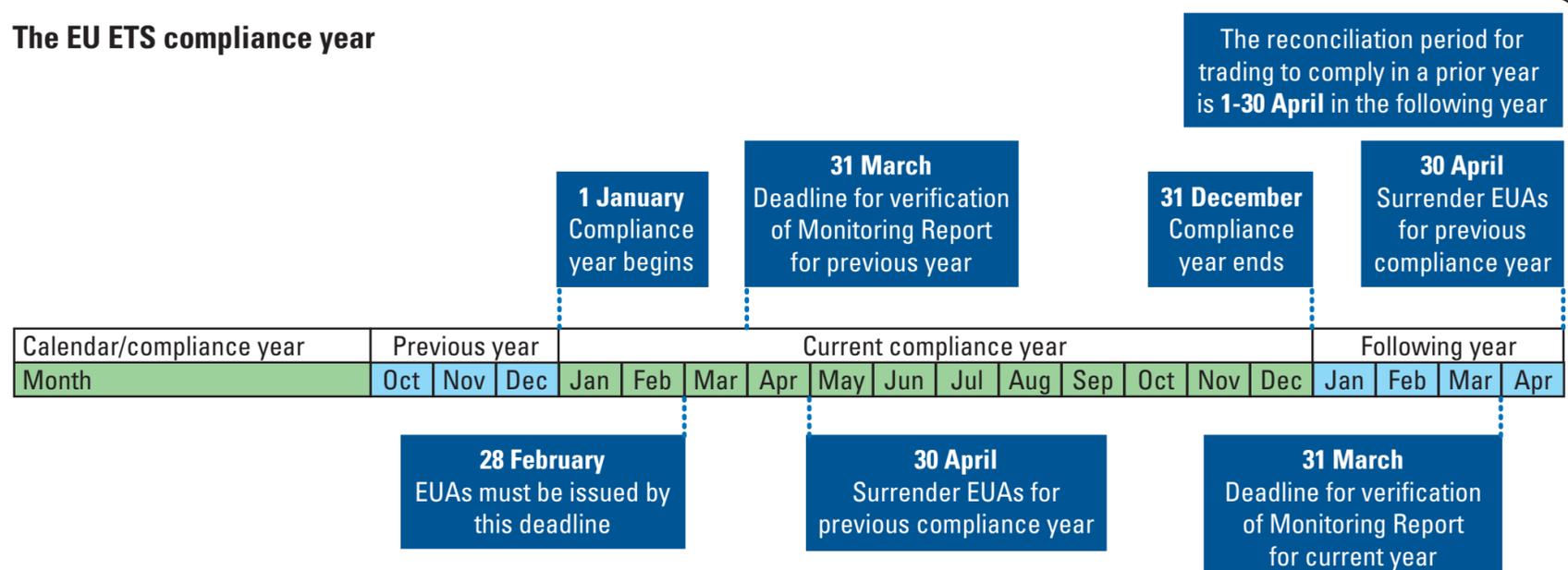
Directive 2003/87/EC of the 13th October 2003 *establishing a scheme for greenhouse gas emission allowance trading within the Community and amending Council Directive 96/61/EC, henceforth referred to as the 'EU ETS Directive'*

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Milestones in a CCS project



The EU ETS compliance year



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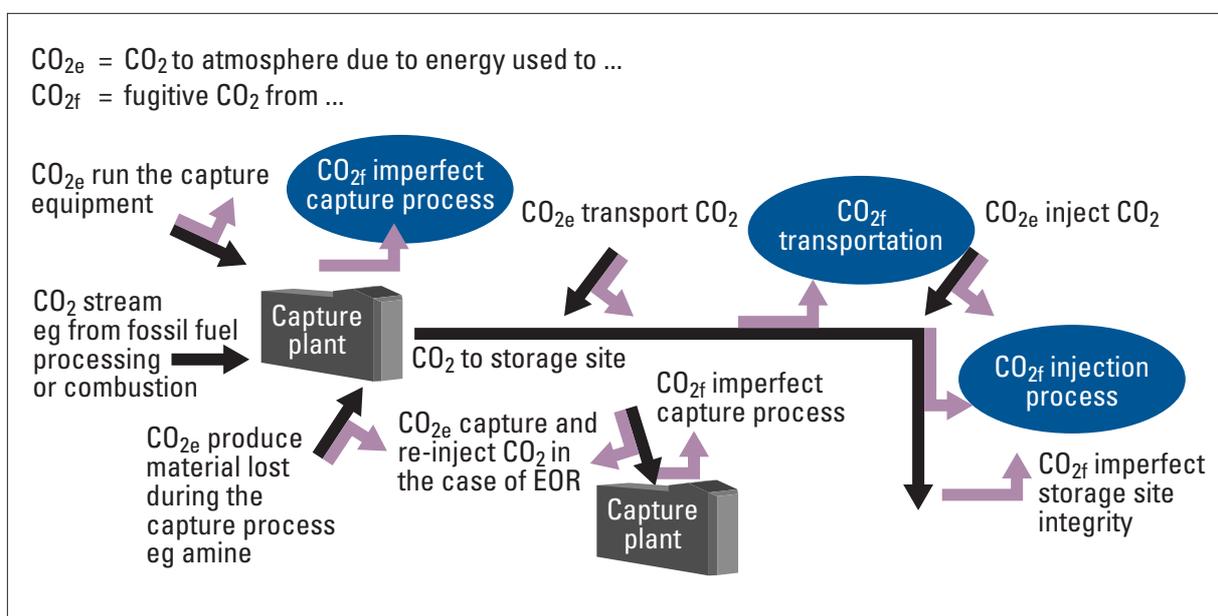
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Liability in this context refers only to the assigning of responsibilities for monitoring and reporting of CO₂ emissions across a CCS chain. Associated with this will be the debiting of physical CO₂ leakage against the amount of emissions reductions attributable to an exporting installation, or the amount of emissions allowances that must be surrendered by an installation under a cap and trade scheme (or 'reconciliation').



Emissions sources across a CCS chain (summarised by Haefeli et al 2003)

During this work, the default assumption was that CCS chains would evolve through the engagement of several contracting parties each responsible for capturing, transporting and storing CO₂: capture by the installation operator; transportation by another party commercially motivated to operate pipeline networks, and storage again by a different party, who are likely to be oil & gas companies in the early stages of CCS.

Treatment of Storage Sites

In order to account for any potential future emissions of the stored CO₂ back to the atmosphere, some observers have suggested that any emissions reductions credit given to project or installation operators employing CCS should be subject to some form of discounting. Alternatively, it has also been suggested that default factors could be developed and applied that assume a standard rate of leakage. However, these approaches are considered to present a number of problems in that:

- (i) they assume that the storage site will leak over a set timeframe
- (ii) this timeframe, and the flux rate can be established ex ante based on detailed understanding of the storage reservoir characteristics and the behaviour of the sub-surface stored CO₂
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However, storage sites would need to be controlled under an appropriate regulatory regime. This is not in place yet in the EU Member States. Some considerations for storage site permitting and licensing are as follows:

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Recommendations

It is proposed that in order to maintain the environmental integrity of a cap and trade scheme such as the EU ETS, fugitive emissions occurring outside the installation boundaries should be reconciled with the estimated quantity of CO₂ transferred at the installation's CO₂ export point, within the annual timeframe of the EU ETS reconciliation process.

This requirement is particularly pertinent in the case of the EU ETS because:

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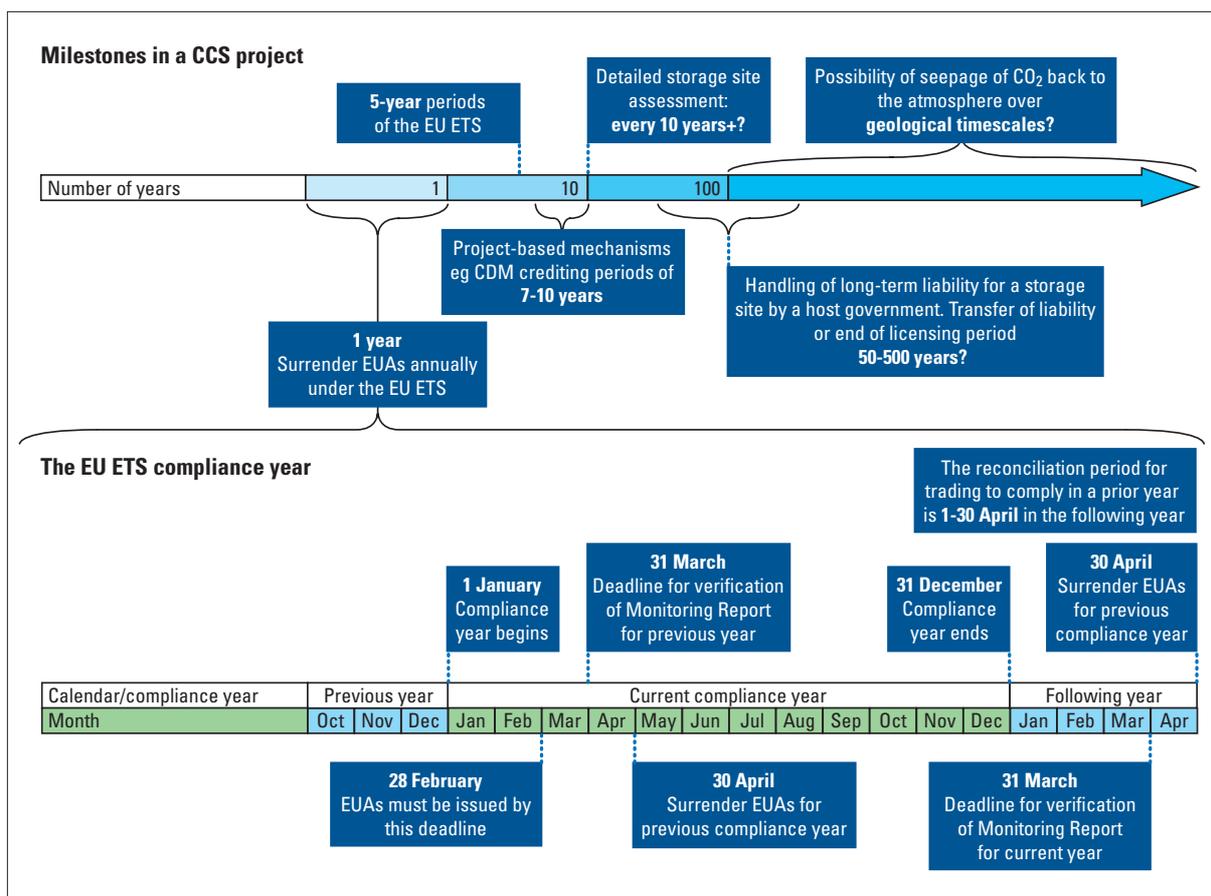
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- Indirect CO₂ emissions associated with energy used in compression or cooling of CO₂ during transport and injection.
- Indirect CO₂ emissions associated with the energy used in manufacture of CO₂ stripping agents.
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Milestones in a CCS chain under emissions trading schemes (by P Zakkour 2005)

References

Developing Monitoring, Reporting and Verification Guidelines for CO₂ Capture and Storage under the EU ETS. Dr P Zakkour, C Girardin, L Solsbery, S Haefeli, P Murphy. Jan 2005. Report Coal R277 DTI/Pub URN 05/583

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