Carbon trading

Reduction in carbon emissions is central to the negotiations at the UN COP meetings. Following Copenhagen (COP-15) (see sustainability briefing in *The Structural Engineer* **88**/2, 19 January 2010, p10), the negotiations will resume later in 2010 at Cancün in Mexico. This note, on carbon trading, has been prepared to help structural engineers in understanding this complex topic, to encourage them in following reports and to enable them in contributing to discussions.

In a world where there is an obligation to reduce carbon emissions, Governments could issue an instruction to all carbon emitters that they must reduce emissions by a certain amount. This system of Command and Control makes no distinction, between carbon emitting companies, of the cost of cutting carbon.

What is emissions trading?

Emissions trading is a mechanism devised to regulate and control carbon emissions. There are two types of market-driven schemes which create forces to incentivise reduced carbon emissions.

'Price instrument' using a tax, levied at a fixed price, with the quantity of emissions allowed to float. A carbon tax increases the competitiveness of non-carbon technologies compared to the traditional burning of fossil fuels, thus helping to protect the environment while raising revenues.

'Quantity instrument' using a fixed quantity allowance and floating price. In this system a value is created for carbon emissions, which are then either exchanged or traded. Government progressively reduces the size of the fixed quantity allowance, maintaining and increasing the value of carbon credits. This is 'emissions trading'.

Emissions trading should ensure that emissions reductions are made at least cost to industry. Such a system is attractive to Governments, which need to maintain competitiveness of their countries. This is in contrast to a command and central control mechanism, where emissions might be reduced by mandate, regardless of cost to the company. It is also more attractive than a taxation system, which requires detailed Government invention and operation; in contrast a trading scheme, once operating, requires minimal Government intervention.

The effect of incentivising efficient carbon reduction, through least cost to industry, is demonstrated by the example in Table 2.

In this example, Company A and Company B are both required by law, through an emissions allocation, to either reduce emissions by 20% or to trade emissions to an equivalent emission reduction. Under the Command and Control system (Table 1), both companies cut emissions – this costs company A more than it costs Company B and the combined cost is €3400. Under an Emissions Trading System, companies are allowed to buy from the market if their own emissions cut is insufficient or to sell surplus emissions to the market if their cut exceeds their allocation.

The ability to trade carbon between the companies provides an incentive to the company that can cut carbon more cheaply (in this case Company B). Both companies are required to show a saving of 20t of Carbon. The cut is enforced by fines which, to be effective, must cost the company more than reduction in emissions. Company A reduces its emissions by 10t and buys the other 10t on the market, at €80/t. Company B cuts its emissions by 30t and sells its surplus of 10t of carbon into the market and receives €800. Thus, through emissions trading, the saving in carbon is achieved at an overall lower cost (€3100) than a blanket cut of 20t per company.

For the market to be effective in driving lower carbon emissions, there needs to be a shortage of carbon. Shortage drives the price of carbon credits up, incentivising reduction. Such Government measures introduced to reduce carbon and to drive up the cost of carbon credits are called 'Cap and Trade'. The Cap is an agreed enforceable limit on emission and Trade is the activity of the Carbon market. To make sure this shortage exists, the allowances under the trading scheme must be less than a 'business as usual scenario'.

History

The Kyoto protocol, which was set to operate in the period 2008-2012, was introduced to achieve 'stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system'. It quantified greenhouse gas emissions targets for 'Annex 1' parties (developed countries and countries in transition) and this led to the EUETS (European Union Emissions Trading System), the largest multi-national trading scheme in the world and a major pillar of EU climate policy

The EUETS

The EUETS currently covers more than 12 000 installations in the energy and industrialised sectors, which together account for more than half of the EU's emissions of CO_2 and 45% of its greenhouse gas emissions. This is the largest trading scheme in the world and so it is discussed in some detail.

The EUETS creates a market for carbon emissions, which allows trading to take place. The trading unit is one unit of carbon dioxide emitted or 1t CO_2e – this is called an EU allowance (EUA). Thus

	Start emissions	Cost of reduction	End emissions	Carbon cost/ credit	Cost of reduction
Company A	100t	€100/t	80t	–	20 x 100 = €2000
Company B	100t	€70/t	80t	–	20 x 70 = €1400
Total	200t		160t		€3400

Table 1 Command and control – Government issues an instruction, enforced by fines, that all emitters of carbon should produce a 20% cut in emissions

	Start emissions	Cost of reduction	End emissions	Carbon cost/ credit	Cost of reduction
Company A	100t	€100/t	90t	+10 x 80	10 x 100 + 800 = €1800
Company B	100t	€70/t	70t	–10 x 80	30 x 70 – 800 =€1300
Total	200t		160t		€3100

Table 2 Emission trading – Assuming carbon price of €80/t

	Start emissions	Cost of reduction	End emissions	Carbon cost/ credit	Cost of reduction
Company A	100t	€100/t	85t	+5 x 60	15 x 100 + 300 = €1800
Company B	100t	€70/t	75t	–5 x 60	25 x 70 – 300 = €1450
Total	200t		160t		1600 + 1500 = €3100

Table 3 Emission trading fails to operate – Assuming carbon price of €60/t – no incentive for Company B

	Start emissions	Cost of reduction	End emissions	Carbon cost/ credit	Cost of reduction
Company A	100t	€100/t	100t	+20 x 60	1200 = €1200
Company B	100t	€70/t	100t	+20 x 60	1200 = €1200
Total	200t		200t		= €2400

Table 4 Emission Trading fails to reduce carbon emissions – Assuming carbon price of €60/t and excess of credits in the system

'price of carbon' is the cost of an EUA on the market. Incidentally, the molecular weight of carbon is 12, that of oxygen is 16 and so 1t of carbon dioxide (molecular weight 44) contains around $^1/_4$t of carbon.

The key to success of the European trading system is setting the cap on emissions. The cap is set in the National Allocation Plan (NAP), which is submitted by each Member State and approved (or not) by the European Commission. Clearly in the market the cap determines the price of carbon, which determines investment in the technology, which leads to an efficient reduction in carbon emissions. Setting the cap too high leads to a price of carbon too low to justify investment to motivate emission reductions.

Features of the EUETS

Applies to specified industry sectors only. At present these include power, some building materials, oil and gas, iron and steel, pulp and paper and 'other combustion' but not transport.

– Phase I – 2005-2007 – learning period;
– Phase II – 2008-2012 – Kyoto period;
– Phase III – 2013-2020.
– Applies to CO_2 only;
– Allowances operated through NAPs and distributed through free allocation and auctions;
– Auction volumes limited to 5% in Phase I and 10% in Phase II;
– Not all governments auction in Phase II;
– 100% auction for power section in Phase III.

The EUETS currently covers 2bn t of CO_2 per annum. Power generation accounts for around 30% of EU CO_2 emissions and 65% of emissions covered by the scheme.

EUETS and the rest of the world

EUETS is not a closed loop scheme. Installations can set off emissions by purchasing credits from other countries. The limits to the amount of trading is set by the Kyoto mechanisms, which are defined in the Clean Development Mechanism (CDM) and Joint Implementation (JL).

Under EUETS, a carbon credit is an 'allowance' to emit one tonne of CO_2, hence there is an EU Allowance (EAU). Under CDM/JL, a carbon credit is a guarantee that emissions have been reduced below a 'business-as-usual' level. This leads to Certified Emission Reductions (CERs), Emissions Reduction Units (ERUs)

A guide to terminology and acronyms in carbon trading		
Cap and Trade	The principle behind carbon trading. Limit (cap) the amount of emissions legally permitted and allow countries/operators to buy (trade) certified emissions generated by others. The value of the certified emissions is important. If certified emissions (carbon credits) are worth too little, there is little incentive for their creation.	
Contraction and Convergence	The industrially developed world generates to many emissions. The industrially under-developed world would like to generate more. Total emissions should reduce thus the developed world's emissions should contract and the combined emissions of the developed and under-developed nations should converge on a total that is less than the present.	
EUETS	European Union Emissions Trading Scheme	Largest multi-national emissions trading scheme in the world.
NAP	National Allocation Plan	National emissions cap for EU member state under the EUETS. For the scheme work in cutting emissions, the allocation must be less than what would have been emitted in 'business as usual'
EUA	EU emissions Allowance	A carbon credit (allowance) under the EUETS to emit 1t of CO2 equivalent
JL	Joint Implementation	Defined in Kyoto Protocol. This produces the ERU
ERU	Emissions Reduction Unit	Under the JL, one ERU is the successful emissions reduction equivalent to 1t of carbon dioxide equivalent
CDM	Clean Development Mechanism	Defined in Kyoto Protocol. This sets down the Kyoto mechanism for certifying emissions reductions. CERs are issued under the CDM.
CER	Certified Emissions Reductions	Under the CDM, one CER is the certified emissions reduction equivalent to one tonne of carbon dioxide equivalent. CERs can be bought from the primary market (from the party making the reduction) or from the secondary market (resold in marketplace). These are a form of 'climate credit' or 'carbon credit' and are used by countries or by operators to show compliance with obligations under the EUETS
CDM/JL		The mechanisms that define trading under the Kyoto Protocol
VER	Voluntary Emissions Reductions	Carbon credits developed by carbon offset providers, which are not certified

and Voluntary Emission Reductions (VERs).

Savings in carbon on a CDM registered project in a developing country can be transferred to an EU emitter, in exchange for money paid into the developing country.

Summary

Positives:

- Supports 'polluter pays' principle;
- Takes in a large number of operators;
- Secondary market in carbon developing;
- Phase II price helps continuity of CDM investment;
- EU companies have gained advantage over competitors in other countries and have developed links with developing countries through CDM.

Negatives:

- Phase I allocations too high and there was a price crash in carbon in 2006 and 2007 (from €30/t in 2004 to €0.03 in December 2007);
- The free allocation led to excess profits and competitive distortions;
- Current price collapse, due to recession (€30.53 on 1 July 2008 to €8 in March 2009 to settle to around €15 during the first half of 2010) could delay investment in clean technology;
- Carbon trading only relates to supply – it does nothing directly to incentivise energy reduction by the user. If it leads to increase in energy prices, this clearly encourages energy conservation but this is an indirect effect;
- If the carbon price is too low the incentive towards carbon reduction is lost – it is cheaper to buy carbon credits than to cut carbon emissions.

The example in Table 2 used a carbon credit price of €80/t. If the value of carbon credits falls to less than the cost to Company B of reducing emissions, Company B has no incentive to sell credits onto the market. Table 3 shows that it costs Company B more to cut emissions that it receives in trading its surplus on the market. It would be cheaper for both companies to buy credits on the market.

The emissions trading market was created by allocations of carbon credits. Due to the reduced demand for energy caused by the recession, the market can operate with an imbalance in carbon credits – credits bought do not have to equal credits created by emissions cuts. Table 4 shows how the trading scheme can create a situation where credits are bought in preference to emissions reductions.

If the emissions trading scheme is to be effective, Government must intervene to tighten the Cap and reduce the availability of Carbon Credits. Alternatively they could wait for an increase in demand in energy demand to drive up the price of emissions. Some say that the emissions trading scheme is discredited as an effective mechanism and carbon taxation should be introduced.

Whatever emissions controls are introduced, the structural engineer will feel the impact of carbon indirectly. If carbon emissions trading is successful, high carbon emitting operators will be penalised by having to purchase expensive credits. This will lead to a continuous reduction in carbon emissions and, in due course, 'a low carbon economy'. In a low carbon environment, high emission products (generally high-embodied carbon products) will be expensive and the structural engineer will be deterred from their use through the normal process of economic forces.

Further information

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Post publication comment

Readers are advised that the term 'Contraction and convergence' explained in the table *A guide to terminology and acronyms in carbon trading* is protected to GCI by IPR and ETS. The term relates to a specific model of future emissions that was introduced to the United Nations Framework Convention on Climate Change (UNFCCC) in 1996 by GCI for the purposes of achieving UNFCCC-compliance. A full explanation and Definition Statement for Contraction and Convergence is available at: http://www.gci.org.uk/briefings.html. Extensive information about the international acknowledgement of the origin of Contraction & Convergence and the support for it can be found at http://www.gci.org.uk.