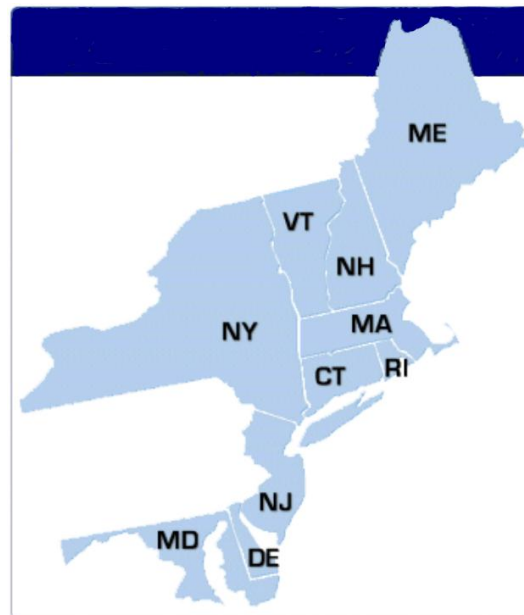


Regional Carbon Cap-and-Trade Under Siege

Maggie Y.M. Lee

In the November 2010 issue of the newsletter, our article on [carbon trading](#) discussed the features of market-based trading programs intended to encourage nations and individual companies to voluntarily reduce greenhouse gas (GHG) emissions. Critics have described the programs as flawed and ineffective.¹ Carbon trading (also known as emissions trading) has been the topic of much heated debate in the U.S. in the past few months. In a country where energy-related decisions are guided more by politics than science, this hardly comes as a surprise.

The states of New Hampshire, Delaware, and Maine were on the verge of dropping out of a regional emissions cap-and-trade initiative, but state legislators ultimately voted to remain in the joint program. In May 2010, however, the governor of New Jersey announced an executive decision to withdraw from the initiative at the end of 2011. This article takes a look at the Regional Greenhouse Gas Initiative of northeastern U.S., the first and only government-mandated emissions cap-and-trade program in operation in North America, and other regional initiatives.



Source: RGGI

Figure 1. States participating in Regional Greenhouse Gas Initiative (RGGI) Metrics for Greenhouse Gas Emissions

Since carbon dioxide (CO₂) is the principal GHG created as a result of human activities, it serves as a reference point for the measurement of all GHG emissions. The Intergovernmental Panel on Climate Change (IPCC) uses the global warming potential (GWP) to quantify the propensity of one unit mass of a GHG to heat up the atmosphere, relative to one unit mass of CO₂, integrated over 100 years (GWP₁₀₀). As the reference gas, CO₂ has a GWP of 1.

The IPCC defines the term “equivalent CO₂ emission,” often shortened as “CO₂ equivalent (CO₂Eq or CO₂e),” as the amount of CO₂ emission that would cause the same integrated radiative forcing, over a given time horizon, as an emitted amount of a well-mixed GHG or a mixture of well-mixed GHGs. It is a standard and useful metric for comparing emissions of different GHGs, but does not imply exact equivalence of the corresponding climate change responses. An alternative unit is “carbon equivalent (CE),” in which carbon is used as the reference and other greenhouse gases may be converted to carbon equivalents (see below). Essentially, this practice accounts for the carbon in the CO₂ molecule, as opposed to counting the entire molecule. The conversion between CO₂Eq and CE is directly related to the ratio of the atomic mass of a CO₂ molecule to the atomic mass of a C atom (44:12).

The equivalent CO₂ emission is obtained by multiplying the emission of a well-mixed GHG by its GWP for the given time horizon. Carbon dioxide equivalents are commonly expressed in units of teragrams or million metric tons, as denoted by TgCO₂Eq or MMTCO₂Eq. The carbon dioxide equivalent for a gas is derived by multiplying the volume in tons of the gas by the associated GWP:ⁱⁱ

$$\text{TgCO}_2\text{Eq} = \text{MMTCO}_2\text{Eq} = (\text{million metric tons of a gas}) \times (\text{GWP of the gas}) \quad (1)$$

For a mix of GHGs it is obtained by summing the equivalent carbon dioxide emissions, i.e., CO₂Eq, of each gas:ⁱⁱⁱ

$$\text{TgCO}_2\text{Eq} = \text{MMTCO}_2\text{Eq} = \sum_{PFC} \frac{Q}{10^9} \text{GWP}_{100} \quad (2)$$

and the corresponding carbon equivalent in million metric tons is

$$\text{MMTCE} = \sum_{PFC} \frac{Q}{10^9} \left(\frac{12}{44} \right) \text{GWP}_{100} \quad (3)$$

where Q measures the amount of emission in kilograms (kg) by a gas species that contributes to global warming, Q/10⁹ is the emission in teragrams (1 Tg is equal to 10¹² grams, or one million metric tons), the fraction 12/44 represents the ratio of the molecular weight of carbon to CO₂, and GWP₁₀₀ measures the ratio of global warming of one unit mass of a GHG to one unit mass of CO₂ over 100 years.^{iv}

While the international standard is to express emissions in CO₂Eq, many U.S. sources have traditionally expressed emissions data in terms of CE. In particular, the U.S. Environmental Protection Agency (EPA) has used the CE metric in the past for budget documents. The benefits of voluntary programs have often been expressed in MMTCE. The EPA’s Office of Transportation and Air Quality (OTAQ) uses the CO₂Eq metric for the national inventory for GHG emissions. To comply with international practice, OTAQ is moving towards using the CO₂Eq metric to characterize the benefits of its voluntary programs. Emission reductions from voluntary programs will generally be expressed in MMTCE. For the purposes of national GHG inventories, emissions are expressed as teragrams of CO₂ equivalent (TgCO₂Eq).^v

International Trading of CO₂-Equivalent Allowances — Market Prone to Abuse and Fraud

Emissions trading, also known as carbon credit trading or simply carbon trading, is a market-based approach first adopted by the United Nations to achieve environmental objectives through economic incentives. Using a quota system, each country is assigned a maximum acceptable level of emissions, calculated from the emission reduction and limitation commitments under the Kyoto Protocol^{vi} (see [August 2010 newsletter article](#)^{vii}). Emissions trading allows countries that are reducing GHG emissions below their emission cap to use or trade the excess reductions to offset emissions at another source inside or outside the country. A carbon credit is a tradable permit or allowance representing the right to emit one metric ton of CO₂ or the mass of another GHG with a CO₂Eq of one metric ton of CO₂. Trading can occur at the intra-company, domestic, and international levels. Such a scheme allows developed countries, major sources of industrial and residential GHG emissions, to meet climate targets by funding cuts and projects such as wind power and improved efficiency in developing nations.

The European Union's Emissions Trading Scheme (ETS), the most advanced trading system, serves as a model for the carbon market in the U.S. and other countries. Critics have called ETS flawed because a rich country can "cut" emissions without actually releasing fewer and smaller volumes of GHGs by paying a poor country to emit less than it would otherwise.^{viii} Some corporations and global conglomerates are accused of treating lenient emissions trading as a huge opportunity to boost profits. Developing countries have also expressed dissatisfaction with what amounts to compromising their industrialization goals and to having their natural resources turned into commodities traded on exchanges in wealthy countries.^{ix}

At the end of 2009, an investigation conducted by London-based Carbon Market Data revealed that the ETS had issued ArcelorMittal, the world's largest steel producer based in Luxembourg, carbon credits far in excess of its requirements. The investigation also showed that ArcelorMittal and Eurofer, which represents European steel makers, had lobbied intensively in Brussels, including threatening to move plants out of Europe at a cost of 90,000 jobs.^x

According to newspapers in the U.K, the company was entitled to the sale of these carbon credits, providing a windfall estimated at £1 billion by 2012. If it decides to save the credits for future use instead of auctioning them off, it is allowed to emit 90 Tg of CO₂ or its equivalent in GHGs from its 80-plus steel plants in the E.U. up till 2012, backdated to 2008. In essence, hoarding the surplus credits allows it to avoid cutting GHG emissions, thus defeating the purpose of ETS. It will be the largest, single beneficiary of carbon credits under the scheme. Owing to lower production as a result of the global economic crisis, the company emitted only 60 TgCO₂Eq in 2008 and 2009 emissions was estimated to be only 43 TgCO₂Eq. Even if steel production recovers sufficiently to use the stockpile of credits, the company will have accumulated surplus permits for 80 TgCO₂Eq by 2012, the equivalent of annual pollution generated by Denmark. An ETS expert commented that for ArcelorMittal, "the ETS has been turned into a system for generating free subsidies."^x

Europe's second biggest steel producer after ArcelorMittal, Corus (a wholly-owned subsidiary of India's Tata Steel that was renamed Tata Steel Europe) did not fare as well. Due to rising debt, Tata's key British plant in Teesside in northern England was shuttered, with a loss of 1700 jobs. Tata was due to receive 7 million free permits (7 TgCO₂Eq) worth around US\$147 million but instead of cancelling the permits, the U.K. Department of Energy and Climate Change opted to sell them in the open market, superficially conforming to EU's auction policy. The decision outraged environmentalists who felt the move was hypocritical, non-conducive to

job protection, and did not help finance alternatives to continued reliance on coal. In cancelling Teesside's permits, the U.K. could realize up to 1% cut toward its 2050 emissions goal by ensuring these gases would never be released into the atmosphere. If auctioned, the proceeds would go to Treasury coffers rather than being earmarked to fighting climate change or creating jobs.^{xi,xii}

In 2010, critics disputed the validity of the Kyoto Protocol's Clean Development Mechanism (CDM, see [November 2010 newsletter](#)) altogether. At issue were 22 chemical producers in China and India, which were allegedly overproducing ozone-depleting chlorodifluoromethane (CHClF₂, Freon 22, or HCFC-22) in order to profit from selling "phony carbon credits" through destruction of its byproduct trifluoromethane (CHF₃, Freon 23, or HFC-23), a potent GHG with a global warming potential (GWP) of 11,700. The chemical makers were paid as much as \$100,000 or more for every ton of HFC-23 destroyed.^{xiii,xiv}

With the Kyoto Protocol expiring at the end of 2012, renewal of each country's pledge will hinge on revised binding commitments that are agreeable to all delegates. Determining factors also include alternatives to cap-and-trade, amendments to ETS offsets, and strategies to close CDM loopholes. One option for ETS is shifting to an auction model, like the cap-and-trade in northeastern U.S., which can generate revenue. Japan, Canada, and Russia have decided against renewal of their commitments after 2012. Other countries want a model that can include the U.S., which did not ratify the Protocol because it permits continued non-commitment of developing countries.^{xv}

ⁱ M.Y.M. Lee, "Carbon Trading Ineffective in Curbing Greenhouse Gas Emissions," *Gases & Instrumentation Newsletter*, Gases & Instrumentation, Wellesley, MA, http://www.gasesmag.com/features/G&I_November2010eNewsletter_CarbonTrading_v5_20101209.pdf (November, 2010)

ⁱⁱ "Glossary of Climate Change Terms," U.S. Environmental Protection Agency, Washington, DC, <http://www.epa.gov/climatechange/glossary.html>

ⁱⁱⁱ "Annex 1, Glossary," Ed. A.P.M. Baede, "Working Group I Report: The Physical Science Basis," IPCC Fourth Assessment Report: Climate Change 2007, Intergovernmental Panel on Climate Change, Geneva, Switzerland, p. 945 (2007)

^{iv} A.D. Johnson, W.R. Entley, P.M. Maroulis, "Reducing PFC gas emissions from CVD chamber cleaning," *Solid State Technology*, Nashua, NH (December, 2000)

^v "Emission Facts: Metrics for Expressing Greenhouse Gas Emissions: Carbon Equivalents and Carbon Dioxide Equivalents," EPA420-F-05-002, U.S. Environmental Protection Agency, Washington, DC, <http://www.epa.gov/oms/climate/420f05002.htm#global> (February, 2005)

^{vi} "Annex 1, Glossary," Ed. A. Verbruggen, "Working Group III Report: Mitigation of Climate Change," IPCC Fourth Assessment Report: Climate Change 2007, Intergovernmental Panel on Climate Change, Geneva, Switzerland, p. 814 (2007)

^{vii} M.Y.M. Lee, "Greenhouse Gases Explained," *Gases & Instrumentation Newsletter*, [http://www.gasesmag.com/Feature\(1\)_GHG_Lee_August_2010.pdf](http://www.gasesmag.com/Feature(1)_GHG_Lee_August_2010.pdf) (August, 2010)

^{viii} J. Hari, "Leaders of the rich world are enacting a giant fraud," *The Independent*, London, U.K. (December 11, 2009)

^{ix} J.M. Broder, "World Bank Will Help Finance Carbon Markets," *Green.blogs.nytimes.com*, The New York Times, New York, NY, <http://green.blogs.nytimes.com/2010/12/08/world-bank-will-help-finance-carbon-markets/> (posted December 8, 2010; retrieved July 5, 2011)

^x J. Leake, B. Pancevski, "Carbon credits bring Lakshmi Mittal £1bn bonanza," *The Sunday Times*, London, U.K. (December 6, 2009)

^{xi} "Carrying carbon to Copenhagen: EU & UK," *MinesandCommunities.org*,

<http://www.minesandcommunities.org/article.php?a=9743> (posted December 12, 2009; retrieved November 24, 2010)

^{xii} “UK to cash in on closed steel plant carbon permits,” *Reuters* (December 10, 2009)

^{xiii} J. Heilprin, “UN report fuels criticism of carbon-cutting scheme,” *Associated Press* (July 2, 2010)

^{xiv} J. Heilprin, “UN board could rein \$2.7 billion carbon market,” *Associated Press* (August 21, 2010)

^{xv} A. Max, “Expiry of emissions pact in 2012 bedevils talks,” *Associated Press* (June 6, 2011)

Climate Will Not Wait

We have been working hard this spring and summer. Hot on the tails of our series of investigative reports on the Tohoku Earthquake’s impact on the industrial market, we have prepared a series of reports on climate change and greenhouse gas (GHG) emissions. In addition to articles that have appeared in previous issues (“Greenhouse Gases Explained,” “Carbon Trading Ineffective in Curbing Greenhouse Gas Emissions,” “Fluorinated Substitutes: the Lesser Evils?”) and today’s newsletter (“Metrics for Greenhouse Gas Emissions,” “International Carbon Trading Prone to Abuse and Fraud”), our new reports cover a range of interesting and controversial topics:



Fossil fuel combustion as leading source of CO₂ emissions and frequent subject of political debate in the U.S.



Regional Greenhouse Gas Initiative (RGGI) — Only GHG cap-and-trade program in North America

- How RGGI and carbon pricing work — Carbon cap-and-trade is not a tax.
- Plunging carbon prices and dwindling interest in U.S. carbon market during financial recession
- State investments and benefits using RGGI CO₂ auction proceeds
- Effectiveness of RGGI questioned by state legislators and conservative groups
- RGGI under attack in Delaware, Maine, New Hampshire, New Jersey, and New York
- Other regional initiatives in the work: Western Climate Initiative and Midwestern Greenhouse Gas Accord

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