



Reducing HFC-23: A Crucial Component of the Battle against Global Warming

Destruction of HFC-23s is one of the more debated means to reduce greenhouse gas emissions, but its benefit to the environment is clear. Evolution Markets' Carbon Market Analyst **Ross MacWhinney** comes to a pragmatic defense of HFC-23 projects.

Projects that reduce emissions of HFC-23 yield high numbers of offsets and have attracted a good deal of attention in the market for Certified Emission Reductions (CERs) – the product of the Kyoto Protocol's Clean Development Mechanism (CDM). With their low cost of production, HFC-23 reductions are the proverbial low-hanging fruit of the CDM market. However, these projects have also come under considerable criticism in the past year. Nevertheless, this low-hanging fruit should be picked. It provides financial incentives for over-compliance and early action, thereby enhancing environmental benefits. No doubt there are good HFC-23 projects and bad HFC-23 projects, but buyers in either the CDM or voluntary carbon credit markets should focus on quality and not hesitate from investing in this type of offset. This EvoBrief attempts to shine a light on the features, benefits, and concerns involved with HFC-23 reduction projects in the carbon markets today.

HFC-23 Properties

HFC-23 has 11,700 times the global warming potential (GWP) of carbon dioxide (CO₂), with a long atmospheric lifetime of 260 years and a sizable capacity to radiate heat back towards the earth's surface (radiative efficiency = 0.19Wm⁻²ppb⁻¹). It has the highest GWP of all hydrofluorocarbons (HFCs) and the second highest among the 6 greenhouse gases covered under the Kyoto Protocol (see Table 1 below). HFC-23 has industrial uses in plasma-etching processes in semiconductor manufacturing and as a blend component in fire suppression. However, the bulk of HFC-23 generation occurs as a byproduct of the production of HCFC-22, which is used primarily as a refrigerant and as a feedstock for manufacturing synthetic polymers. HCFC-22 itself is an ozone depleting substance which has been scheduled for phase-out by 2030 under the Montreal Protocol (see Table 2).

Table 1: Global Warming Potentials (100 Year Time Horizon)ⁱ

Gas	GWP
Carbon dioxide (CO ₂)	1
Methane (CH ₄)*	23
Nitrous oxide (N ₂ O)	296
HFC-23	11,700
HFC-32	550
HFC-125	3,400
HFC-134a	1,300
HFC-143a	4,300
HFC-152a	120
HFC-227ea	3,500
HFC-236fa	9,400
HFC-4310mee	1,500
CF ₄	5,700
C ₂ F ₆	11,900
C ₄ F ₁₀	8,600
C ₆ F ₁₄	9,000
SF ₆	22,200

Source IPCC – Third Assessment Report (2001)

Cost-Effective Reductions

HFC-23 reductions (involving incineration of the gas or changes in process) have existed among the low-hanging fruit of the CER market. With their relatively low implementation costs and high reduction yields, these projects represent the most cost-effective opportunities to make reductions in GHG emissions. The high GWP of HFC-23 means that reductions of a quantity of the gas yields roughly 11,700 times the number of CERs that would come from a project that reduced the same amount of CO₂. Prices for these CERs currently range around €16.00/ton. As Carbon Financeⁱⁱ



magazine reported in its February 2007 issue (“The Credit for Destruction”), the Intergovernmental Panel on Climate Change (IPCC) has estimated that CERs created from HFC-23 projects primarily in China and India cost about \$0.20 per ton to produceⁱⁱⁱ. By comparison, the Center for Clean Air Policy has estimated that CERs created from renewable energy projects cost in excess of \$10 per ton to implement.

The CDM Controversy

The cost-effective nature of HFC-23 reductions, particularly as they relate to projects in the developing world, has in fact bred controversy. The profit margins for HFC-23 reduction in the CER market are clearly quite large. Because of these incentives, HFC-23 reduction opportunities on existing HCFC-22 facilities have been largely exhausted in CDM eligible countries.

In and of itself, large profit margins are not the issue. As long as projects have an additional benefit to the environment, the question of profit should be irrelevant. However, there is now concern that the large profit margins associated with HFC-23 projects could encourage investment in new HCFC-22 production capacity, not as a response to a demand for refrigerants, but simply in order to implement reductions projects and collect and sell CERs. This scenario has been labeled as a “perverse incentive” since it encourages managers in developing countries to ramp up production of HCFC-22 and HFC-23 in hopes of being paid for subsequent reductions. While fears regarding this scenario are reasonable, it is difficult to identify specific individual projects in which it has been played out.

Montreal Constraints

The controversy surrounding perverse incentives had been made more complex by the schedule of reductions in HCFC-22 mandated in the developing world under the Montreal Protocol (see Table 2). Under this schedule, HCFC-22 (an ozone-depleting substance) production was to be phased out in the developed world by 2030. These reductions were to be made gradually through intervals of reductions in cap levels. Developing nations, however, had been placed on a less stringent schedule for the phase-out of HCFC-22, freezing their production in 2015 and then holding that level until a full phase-out in 2040. This relaxed reduction schedule meant that

construction of HCFC-22 production facilities would be able to continue unrestricted until 2015 in developing nations, and then could maintain those levels until 2040.

In response to this concern, the United Nations Framework Convention on Climate Change (UNFCCC – the managing body of the CDM) has modified the methodology requirements for HFC-23 incineration projects (monitoring methodology AM0001) to issue CERs only for historical emissions, stating that “The HCFC-22 and CFC production capacities of the facility (CHCFC-22 and CCFC) should be determined based on historical data from the period 2000 to 2004.” This requirement removes the perverse incentive, and should prevent a CER-driven ramp-up of HCFC-22 production in developing nations.

Montreal, Kyoto, and Perverse Incentives

There is continuing debate, however, concerning the decision not to certify reductions from new HCFC-22 facilities under Kyoto’s CDM. Chinese officials have asked for a change in the HFC-23 destruction methodology to allow new plants to generate credits. A recent report issued by the United Environment Program (UNEP)’s Technology and Economic Assessment Panel of the Montreal Protocol also supports this request, stating that: “The worst of all cases would be for HFC-23 emissions to go unmitigated. The inclusion of new plants under the CDM will therefore be necessary in all HCFC phase-out scenarios, especially if HCFC-22 manufacture for feedstock use continues^{iv}.” However, if projects from new HCFC-22 plants were included in the CDM, the risk of a perverse incentive would return to the market. Parties in the Kyoto Protocol are scheduled to meet to consider this issue in Bali this December^v.

Amid concerns of the controversy surrounding HFC-23 under Kyoto, 191 members of the Montreal Protocol reached an agreement on September 21 to accelerate the HCFC phase-out schedule (see Table 2).^{vi} The agreement pushes up full phase-outs of HCFCs by 10 years (2020 in developed nations, 2030 in developing nations). Developing nations are now required to freeze production in 2013 and then make reductions at intervals until 2030. Developed nations have also accepted more aggressive reductions, cutting to 75% of their current cap by 2010. Although this agreement is

Table 2: Montreal Protocol accelerated HCFC phase-out schedule – 9/24/07

	Developed Countries Old Schedule	Developed Countries New Schedule	Developing Countries Old Schedule	Developing Countries New Schedule
January 1, 1996	Cap = 1989 HCFC consumption + 2.8% of 1989 CFC consumption.			
January 1, 2004	Cap reduced by 35% of above			
January 1, 2010	Cap reduced by 65%	Cap reduced by 75%		
January 1, 2013				Cap = freeze at average production levels from 2009-2010
January 1, 2015	Cap reduced by 90%	Cap reduced by 90%		Cap reduced by 10%
January 1, 2016			Consumption freeze at 2015 levels	
January 1, 2020	Cap reduced by 99.5%	Cap reduced by 100%		Cap reduced by 35%
January 1, 2025				Cap reduced by 67.5%
January 1, 2030	Cap reduced by 100%			Cap reduced by 100%
January 1, 2040			Consumption phase-out	

1 Source: UNEP Press Release: Combating Climate Change Given Big Confidence Boost in Canada, <http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=517&ArticleID=5671&l=en>

2 Source: Montreal Protocol, HCFC Phaseout Schedule, Jun 14, 2004, The Alliance for Responsible Atmospheric Policy, <http://www.arap.org/regs/montreal.html> (15 September, 2007)

expected to result in reductions of several billion tons of greenhouse gases, the accelerated timetable does not fully resolve the issues revolving around the perverse incentive scenario.

Worries in the VER Market for HFC-23

The voluntary carbon market, which deals in verified emissions reductions or VERs, has traditionally taken its cues from the market for CERs. VER project protocols often defer to CDM methodologies in evaluating projects. The concept of social side benefits, which now add value to a project in the voluntary market, is one that was inherited from the CDM. Participants in the VER market now may have become spooked by the controversy in the CER market regarding perverse incentives. The VER market appears to also be concerned with two additional issues. First, there is the worry that the focus on HFC-23 reductions tends to dilute financial support for projects from clean and renewable energy projects. A second additional worry relates to the large profit margins involved in these projects. Analysts point out that the same reductions could have been made for much less money by simply donating scrubbers to HCFC-22 facilities^{vii}. This apprehension towards HFC-23 can be seen in the European Carbon Investors and Services' (ECIS) recent Voluntary Offset Standard (VOS) protocol, which has excluded HFC-23 projects from its list of accepted methodologies.

Flaws in This Reasoning

The central flaw in this reasoning is that it fails to correctly distinguish the shapes of the CER and VER markets. Since HFC-23 reductions in the voluntary market are most likely to come from the developed world, worries about perverse incentives are fully irrelevant to this market. HCFC-22 producing facilities are under much stricter mandates for reductions in the developed world due to Montreal. Many companies have also agreed to ad-

ditional voluntary reductions in HCFC-22 production outside of the carbon markets. As a result, the HFC-23 projects that take place in these countries will be above and beyond mandated, as well as voluntary levels. Though these projects still may represent the low hanging fruit of the CDM market, they do not hang quite as low in the developed world. As a result there is no risk of creating a perverse incentive by including these projects in the voluntary market, and the projects are truly additional. If the voluntary market rejects HFC-23 VERs it could be leaving a large quantity of comparatively less expensive GHG emissions in place, while more costly renewable energy projects are pursued, effectively passing up its own cost-effective emission reductions and ignoring a primary function of emissions trading – its ability to locate efficient emissions reductions

Focus on Quality

The future for HFC-23 reduction projects remains firmly in the VER market, while less certain for CERs. The set of solutions being considered by the UN involves the intersection of its two most prominent environmental agreements. If the CDM allows new HCFC-22 facilities to create CERs, there is a real danger of creating a perverse incentive. However without allowing these projects, there is no method to address future greenhouse gas emissions from these sources. The furor and uncertainty regarding perverse incentives in the CER market should not spill over to the VER market, as voluntary HFC-23 reductions in the developing world operate under different regulatory schemes and different economics.

Carbon credit buyers should be aware of issues relating to HFC-23 projects and be able to distinguish between the bad projects (i.e. new plants coming on line to sell carbon credits under the "perverse incentive") and good projects (i.e. old plants implementing reductions over and above their existing mandates). With a focus on quality, buyers can purchase credits from HFC-23 projects with assurance.

- i IPCC, 2001: Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change [Houghton, J.T., Y. Ding, D.J. Griggs, M. Noguer, P.J. van der Linden, X. Dai, K. Maskell, and C.A. Johnson (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 881 pp.
- ii Lancaster, Robin. "The Credit for Destruction." 15 February, 2007 Carbon Finance <http://www.carbon-financeonline.com/index.cfm?section=features&action=view&id=10420> (15 September, 2007)
- iii Special Report on Safeguarding the Ozone Layer and Global Climate System: Issues Related to Hydrofluorocarbons and Perfluorocarbons, Intergovernmental Panel on Climate Change, www.ipcc.ch. Cambridge University Press, UK. pp 478.
- iv The Montreal Protocol and the Kyoto Protocol mutually supportive say top UN Officials, 17 September 2007, United Nations Environment Programme, <http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=517&ArticleID=5668&l=en>, (20 September, 2007)
- v The Montreal Protocol and the Kyoto Protocol mutually supportive say top UN Officials, 17 September 2007, United Nations Environment Programme, <http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=517&ArticleID=5668&l=en>, (20 September, 2007)
- vi UN speeds up HCFC phaseout, September 22, 2007, Bangkok Post, http://www.bangkokpost.com/breaking_news/breakingnews.php?id=121938 (23 September, 2007)
- vii Wara, Michael, Is the global carbon market working? 8 February, 2007, Nature, <http://cas.umkc.edu/geo/GlobalClimateChange/WeeklyActivities/Mar-14/Wara07.pdf> (15 September, 2007)

Evolution Markets Inc.
10 Bank Street
White Plains, NY 10606
T: +1 914.323.0265

<http://www.evomarkets.com>

EVAN A. ARD (editor)
DIRECTOR, MARKETING and COMMUNICATIONS
eard@evomarkets.com

ROSS MacWHINNEY
CARBON MARKET ANALYST
rmacwhinney@evomarkets.com



EVOLUTION
MARKETS