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Donald Kaniaru

Rajendra Shende

Durwood Zaelke

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Landmark Agreement to Strengthen Montreal Protocol Provides Powerful Climate Mitigation

*by Donald Kaniaru, Rajendra Shende & Durwood Zaelke**

Introduction

Last September's historic agreement under the Montreal Protocol to accelerate the phase-out of hydrochlorofluorocarbons ("HCFCs") marked the first time both developed and developing countries explicitly agreed to accept binding and enforceable commitments to address climate change.[1] This is particularly significant because the decision was taken by consensus by the 191 Parties to the Protocol—all but five countries recognized by the United Nations.[2] Accelerating the HCFC phase-out could reduce emissions by sixteen billion tons of carbon dioxide-equivalent ("CO_2e") through 2040.[3] In terms of radiative forcing, this will delay climate change by up to 1.5 years.[4] This is because, in addition to depleting the ozone layer, HCFCs also are potent greenhouse gases ("GHGs")—with some thousands of times more powerful than carbon dioxide ("CO_2") at warming the planet. Thus, from September 2007 both Montreal and Kyoto can be considered climate protection treaties.

The Montreal Protocol offers additional opportunities to reduce GHG emissions.

The HCFC agreement and its climate benefits were possible largely because of the Montreal Protocol's unique history of continuous adjustment to keep pace with scientific understanding and technological capability.[5] The Parties to the Protocol generally regard the treaty as fair, due to its objective technical assessment bodies and its effective financial mechanism, the Multilateral Fund. These features and others have made the Protocol the world's most successful multilateral environmental agreement, phasing out ninety-five percent of global production of ozone-depleting substances in just twenty years and placing the ozone layer on a path to recovery.[6]

The Montreal Protocol offers additional opportunities to reduce GHG emissions further, including by creating greater incentives for the recovery and destruction of ozone-depleting substances currently in chemical inventory or contained in refrigerators, air conditioners, and other products and equipment still in service or not yet disposed.[7] As with the HCFC agreement, these opportunities can achieve immediate and substantial reductions in GHG emissions, as well as further speed the recovery of the ozone layer. More significantly, they can be pursued immediately and independently of the international climate treaty negotiations.

The Montreal Protocol: "Start and Strengthen"

In 1987, the Parties to the Montreal Protocol required a freeze in halon production and a fifty percent reduction in the production of chlorofluorocarbons ("CFCs"), and have continually strengthened the treaty since then as it became clear that ozone protection required that other ozone-depleting substances must be controlled and as new environmentally-superior substitutes and alternatives were developed. This is one of the great strengths of the Protocol, and it did not arise by accident. To the contrary, the treaty is designed to be flexible, allowing the Parties to strengthen and fine-tune its provisions to stay abreast of current scientific understanding and technological capability.[8] As Mostafa Tolba, the fomer UNEP Executive Director and "father" of the Montreal Protocol, has said of the treaty's evolution: "Start and strengthen."[9]

Adding or removing substances from the treaty's control measures generally requires an "*amendment*," which then must be ratified by each Party's government.[10] Amendments can be time-consuming, often taking years, or even decades, before every Party completes ratification. For example, the most recent "Beijing Amendment" agreed on in 1999 did not enter into force until January 2001 and today is ratified only by 135 of the 191

* *Donald Kaniaru is an Advocate for Kaniaru & Kaniaru Advocates located in Nairobi. Mr. Kaniaru is the former Director, Division of Environmental Policy Implementation, for the United Nations Environment Programme ("UNEP"). Rajendra Shende is the Head of the OzonAction Branch in the Division of Industry Technology and Economics at UNEP-Paris. Mr. Shende is an expert on the implementation of multilateral environmental agreements and transfer of environmentally sound technologies to the developing countries, and policy advisor to more than 150 governments for the implementation of the Montreal Protocol. Durwood Zaelke is President of the Institute for Governance & Sustainable Development ("IGSD"); Co-Director for the Program on Governance for Sustainable Development, University of California, Santa Barbara; Director of the International Network for Environmental Compliance & Enforcement; and Partner in Zelle, Hofmann, Voelbel, Mason, & Getty.* *The authors are grateful for the research assistance of Thomas Higdon.*

Parties to the Montreal Protocol. The treaty has been amended four times.[11]

But the Parties can change or, more specifically, accelerate the Protocol's phase-out schedules by "*adjustment*," a procedure used six times. Adjustments do not require ratification and take effect within six months of agreement, except for parties that affirmatively opt out. In the United States, for example, Congress included "adjustments adopted by the Parties thereto and amendments that have entered into force" in its definition of the Montreal Protocol when it incorporated its provisions into the 1990 Amendments to the Clean Air Act.[12]

The adjustment procedure was instrumental in the evolution of the Protocol. The original text of the 1987 Protocol included only CFCs and halon ozone-depleting substances and required developed countries to phase out fifty percent of CFC production by 2000 and to freeze halon production. This was woefully inadequate in terms of protecting the ozone layer, but nevertheless a political and diplomatic triumph given concerns at the time that the science was not yet certain, the substitutes did not yet exist, and the projected costs looked prohibitive.

The adjustment procedure was instrumental in the evolution of the Protocol.

Shortly after the Protocol entered into force, the science of stratospheric ozone depletion and the Antarctic Ozone Hole were confirmed with empirical evidence—showing that the situation was potentially more grave than originally perceived. The modest control measures imposed in 1987 created a market for substitutes and alternatives, which were quickly developed and deployed. And many businesses complied at no cost or, in some cases, at a profit. As a result, the fifty percent phase-out of CFCs by 2000 was subsequently adjusted in 1990 to require a seventy-five percent phase-out by 1998 (and one-hundred percent by 2000), and then adjusted again in 1992 to require a one-hundred percent phase-out by 1996—all within the treaty's first five years. Through amendment and adjustment, the Montreal Protocol now regulates ninety-six different chemicals used in more than 240 sectors and thousands of applications.

Rapid Increase in HCFC Use Threatens Climate as well as Ozone

At their nineteenth meeting on September 22, 2007, the Parties agreed to adjust the Montreal Protocol to accelerate the phase-out of HCFCs. Fittingly, the meeting celebrated the twentieth anniversary of the Montreal Protocol.

HCFCs are ozone-depleting substances regulated under the Montreal Protocol as "transitional" substitutes for the more damaging CFCs. Like CFCs, they were used in a variety of applications, including refrigerators and air conditioners, as foam blowing agents, and as chemical solvents. By 2006, it was clear that the use of HCFCs in developing countries was growing rapidly and threatening the recovery of the ozone layer and potentially undermining efforts to mitigate climate change.

Estimates reported by the Montreal Protocol's Technology and Economic Assessment Panel ("TEAP") showed that HCFC use could exceed 700,000 tonnes by 2015—roughly five times more than the TEAP's 1998 projection of just 163,000 tonnes.[13] The Protocol's Scientific Assessment Panel reported in 2006 that the recovery of the ozone layer to pre-1980 levels would likely be delayed by fifteen years over Antarctica, to 2065, and by five years at mid-latitudes, to 2049, with the delay at mid-latitudes partly due to the high estimates of future production of HCFCs.[14] In addition, the Environmental Investigation Agency reported in 2006 that HCFC emissions by 2015 could cancel out the reductions achieved by the Kyoto Protocol during its first commitment period of 2008–2012.[15]

The increased HCFC use was driven partly by economic growth in developing countries and by a "perverse incentive" under the Kyoto Protocol's Clean Development Mechanism ("CDM").[16] The most commonly used HCFC is HCFC-22, which produces by-product emissions of HFC-23 when it is manufactured. Under the CDM, eligible HCFC-22 producers in developing countries could generate Certified Emissions Reductions ("CERs") by capturing and destroying HFC-23 by-product emissions.[17] HFC-23 is a super-GHG with a global warming potential ("GWP") of 11,700.[18] HFC-23 CERs could earn up to ten times the cost of capturing and destroying HFC-23 emissions and are exceeding the sales revenue of HCFC-22,[19] effectively subsidizing the cost of producing HCFC-22 and driving its expanded use, including in applications where it has not been widely used or had already been replaced.[20]

The original HCFC control measures were not negotiated with these higher than expected levels in mind. Originally, the Montreal Protocol required developing countries to freeze HCFC consumption by 2016 at 2015 levels and phase-out one hundred percent of HCFC production by 2040. It required developed countries to phase out 99.5 percent of HCFCs by 2020, with 0.5 percent allowed for servicing existing equipment until 2030.[21] By early 2007, there was concern that without urgent action, developing countries would have difficulty in complying with the 2016 freeze and the 2040 phase-out.[22]

Montreal Protocol's Success Made It the World's Best Climate Treaty

As it approached its twentieth anniversary, the Montreal Protocol already was widely considered the world's most successful multilateral environmental agreement. But what many did not know is that its success in phasing out ozone-depleting substances also made it the world's best climate treaty—so far.

The publication of a groundbreaking paper in the Proceedings of the National Academy of Sciences ("PNAS") calculated the climate benefits of the Montreal Protocol, and the results helped spur the international community to action.[23] Because

CFCs are such potent GHGs, the Montreal Protocol is reducing emissions by 135 $GtCO_2e$ between 1990 and 2010 and delaying climate forcing by seven to twelve years.[24] When pre-Montreal Protocol efforts to protect the ozone layer are included, such as voluntary reductions in CFCs and domestic regulations in the 1970s, the delay in climate forcing is thirty-five to forty-one years.[25]

The PNAS article drew greater attention to both the ozone and the climate impacts of the increased HCFC use. It became the foundation for key Parties and non-governmental organizations to make the case for strengthening the Montreal Protocol by accelerating the HCFC phase-out to maximize its climate benefits—as well as to ensure the continued success of the treaty in protecting the ozone layer. In particular, the article received considerable attention at meetings of the Stockholm Group, an informal gathering of ozone and climate experts that played a critical role in reviewing the technical and economic data supporting an accelerated HCFC phase-out and building consensus among developed and developing country governments.

Proposals to Accelerate HCFC Phase-Out Cited Climate Benefits

In March 2007, an "unusual coalition" of nine Parties submitted six separate proposals (some jointly) to accelerate the phase-out of HCFCs.[26] Proposals came from both developed and developing countries, and nearly all cited the potential climate benefits of an accelerated HCFC phase-out, as well as the ozone benefits. Small island and coastal developing countries, including Argentina, Brazil, Mauritius, and the Federated States of Micronesia, were among the Parties stressing the need to take immediate action to mitigate the causes of climate change as part of their justification for an accelerated HCFC phase-out. The United States also referenced climate considerations in its proposal, which put forward one of the most aggressive accelerated phase-out schedules.

The Parties met at the 27th Open-Ended Working Group in June 2007, to discuss the proposals and recognized a "clear need to accelerate the timetable for the phase-out of ozone-depleting substances, in particular HCFCs."[27] On June 7, the *G8 Summit Declaration* added further support, committing to "accelerating the phase-out of HCFCs in a way that supports energy efficiency and climate change objectives."[28]

As the twentieth anniversary Meeting of the Parties approached, key Parties and influential scientists and policymakers began to weigh in on the HCFC issue. Dr. Mario Molina, who in 1995 shared the Nobel Prize with Dr. Sherwood Rowland for their work in the 1970s on the impacts CFCs had on the ozone layer, wrote an influential opinion piece for the Financial Times of London, stating,

> Now it is time for the ozone treaty to make its role in reducing climate emissions more explicit. This should start next month with an agreement among the parties to accelerate the phase-out of hydrofluorocarbons in a way that promotes energy efficiency and climate change objectives. . . . In the light of the short time before we reach the planet's 'tipping point,' they cannot afford to fail.[29]

As the negotiations progressed, the key questions, particularly for developing countries, were the availability of substitutes and whether assistance through the treaty's financial mechanism, the Multilateral Fund, would be available.

With regard to substitutes, the evidence clearly showed that they were commercially available for virtually all HCFC applications. The *UNEP 2007 Synthesis Report* concluded that technically and economically feasible substitutes were available for almost all HCFC applications.[30]

Financing the accelerated phase-out was more complicated. Under the 1990 Amendments to the Montreal Protocol, developed country Parties must provide financial assistance, through the Multilateral Fund, to developing country Parties to cover the agreed incremental costs of making the transition out of ozone-depleting substances and into more environmentally friendly substitutes and alternatives. Thus far, the Fund has disbursed approximately $2.3 billion in financial assistance. The high levels of HCFC use, particularly in China, meant that the amount of financial assistance would need to increase substantially to cover incremental costs for HCFCs at a time when many donor Parties were expecting financing for the Montreal Protocol to be winding down. Indeed, many thought the ozone layer problem had already been solved and the time had come to discontinue the Montreal Protocol itself.

HCFC Agreement Provides for Climate-Friendly Substitutes and Financing

After a week of intense negotiations in Montreal, the Parties reached an agreement to accelerate the HCFC phase-out.[31] For developing countries, the new control measures shift the base year from 2015 to an average of 2009 and 2010 and the freeze date from 2016 to 2013. Developing countries must then phase-out ten percent of production by 2015, thirty-five percent by 2020, 67.5 percent by 2025, and 97.5 percent by 2030, with 2.5 percent allowed for servicing existing equipment until 2040. Developed countries, many of which have already completed a transition out of HCFCs, must now phase-out seventy-five percent of production by 2010, instead of sixty-five percent, with a 99.5 percent phase-out by 2020, and 0.5 percent allowed for servicing existing equipment until 2030.

Accelerating the HCFC phase-out will reduce emissions an estimated sixteen $GtCO_2e$ or more through 2040, with the actual climate benefits depending on the success replacing HCFCs with zero and low GWP substitutes, and/or preventing future emissions of these substitutes by providing for a robust system to recover and recycle or destroy used chemicals at equipment end-of-life.[32]

In an effort to maximize these potential climate benefits, the adjustment decision calls on the Parties to "promote the selection of alternatives to HCFCs that minimize environmental impacts, in particular impacts on climate" and to give priority to "substitutes and alternatives that minimize other impacts on the environment, including on the climate, taking into account global-warming potential, energy use, and other relevant factors."[33]

By explicitly referencing the climate impacts of HCFC substitutes and alternatives, the adjustment marks the first time that both developed and developing countries have agreed to accept binding commitments to mitigate climate change.

The adjustment decision also includes provisions to ensure that developing countries receive financial assistance through the Multilateral Fund to make the transition out of HCFCs, although the details of implementation will continue to be negotiated at the Fund's Executive Committee meetings.

The agreement was hailed worldwide. Achim Steiner, the Executive Director of the United Nations Environment Programme, called it "the most important breakthrough in an environmental negotiation process for at least five or six years because it sets a very specific target with an ambitious timetable."[34] Romina Picolotti, Argentina's Minister of Environment and an early and vocal proponent of the accelerated HCFC phase-out, described it as "important for the ozone layer, and even more important for the climate. It shows us what we can do when we have the spirit to cooperate."[35]

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Next Up at the Montreal Protocol: Creating Greater Incentives for the Recovery and Destruction of Banks

There are several other measures that the Parties can take that will mitigate climate change, including the "practical measures" developed as part of the Ozone Secretariat's Workshop on the IPCC/TEAP Special Report held in July 2006.[36] The TEAP calculates that an accelerated HCFC phase-out plus the "practical measures" identified at the Workshop can result in cumulative emissions reductions of about 1.25 million ozone depleting potential ("ODP") tonnes and thirty $GtCO_2e$.[37]

In particular, banks of CFCs and other ozone-depleting substances ("ODSs") represent a significant threat to the ozone layer and the climate. Banks are defined as ODSs contained in existing equipment (e.g. air conditioners and refrigerators), products (e.g. foam insulation), and stockpiles (e.g. the military stockpiles various chemicals for specialized uses). These exist in both developed and developing Parties. Approximately 7.4 $GtCO_2e$ of CFCs, currently contained in banks of existing equipment and products, is expected to be released into the atmosphere between 2002 and 2015.[38] There will be additional significant emissions beyond 2015 as more CFC and HCFC-based equipment reaches end-of-life.[39]

Emissions of CFCs and other ODSs from banks could be avoided by creating greater incentives for their recovery and destruction. This should include allowing destruction credits to carry forward for more than one year, to be traded between Parties, and to transfer among chemical groups, where the destruction of an amount of one chemical, for example, CFCs, would allow the production or consumption of an equal amount, on an ODP-weighted basis, of an ODS from another chemical group, for example, HCFCs.[40] It could include programs to encourage greater recovery and recycling or destruction, such as Refrigerant Reclaim Australia.[41] In addition, the Chicago Climate Exchange issued the first carbon offset methodology in late 2007 that would allow the destruction of ODS banks to generate offset credits.[42]

One additional benefit of a robust recovery and recycle/destruction program is that it undercuts the traditional paradigm where consumption of ODS or ODS substitutes is treated as equal to emissions. With guaranteed recovery and destruction, it would be possible to allow the continued use of certain chemicals whose direct impacts on the ozone and the climate may be high, but whose indirect benefits, such as improved energy efficiency, make them desirable to available alternatives.[43]

There is growing support for new measures creating greater incentives for the recovery and destruction of banks. At the September 2007 Meeting of the Parties to the Montreal Protocol, the Administrator of the U.S. Environmental Protection Agency, Stephen Johnson, challenged, "all delegations to consider ways of destroying the banks of ozone-depleting substances currently installed in equipment. These large sources of CFCs and other ozone-depleting substances represent a ripe opportunity to both further protect the ozone layer and to reduce emissions that contribute to global climate change."[44] At the December 2007 Climate Conference in Bali, the United States, Argentina, Micronesia, and Mauritius answered this challenge at a side event organized by the Institute for Governance & Sustainable Development, where they stated their interest in strengthening the Montreal Protocol to address the threat from banks.

Other Measures

Other strategies for strengthening the Montreal Protocol were described in the original SDLP article,[45] including exempting HCFC-123 from phase-out and allowing its continued use until superior substitutes are developed, based on its negligible ozone impacts and the energy efficiency advantage of HCFC-123 chillers over the primary alternative, HFC-134a, where HCFC-123 results in lower GHG emissions associated with power generation to run the chillers, as well as lower operating costs over the thirty-year life of the equipment.

The Montreal Protocol also should strengthen its compliance efforts by building on work already underway in the Secretariat, UNEP OzonAction's compliance assistance program, and elsewhere, to promote an ambitious capacity building program. This can be accomplished by linking with the Green Customs

Initiative of UNEP, and the International Network for Environmental Compliance & Enforcement. A much more aggressive effort is warranted by the combined ozone and climate benefits from strict compliance.

With regard to the use of ODSs for feedstocks, process agents, and quarantine and preshipment ("QPS") applications, requiring mandatory periodic review of current uses and their direct and indirect impacts on the ozone and climate, utilizing a Life Cycle Analysis, would lay the groundwork for future action banning the use of ODSs where alternatives that are less harmful to the environment are available. Half of the HCFC-22 produced today is used as feedstocks and process agents exempt from the Montreal Protocol accelerated phaseout; and thus half of the global emissions of HFC-23, a super GHG, is a consequence of allowing exempted HCFC uses. Unfortunately, the Montreal Protocol and its TEAP have not yet investigated the technical feasibility of reducing and eliminating these uses—including the options of not-in-kind technology for the products that currently depend on HCFCs in production.

Finally, the Montreal Protocol also should require use of the concept of Life Cycle Climate Performance ("LCCP"), which is considered a practical elaboration of Life-Cycle Analysis. LCCP was proposed by the TEAP to calculate the "cradle-to-grave" climate impacts of the use of ODSs in equipment. Direct emissions result from the leaks of chemicals into the atmosphere. Indirect emissions result from the energy consumption due to manufacturing, operation, and disposal at the end of product life and also account for the carbon content of the fuel utilized in each process and product life. The Mobile Air Conditioning Climate Protection Partnership has posted its LCCP model on the U.S. EPA website showing the combined climate life cycle impact of refrigerant greenhouse gases directly emitted and the indirect greenhouse gas emissions of fuel used to produce, power, transport, and dispose the equipment.[46]

Conclusion

The Montreal Protocol and its success in protecting both the ozone layer and the climate show that global environmental problems can be solved through international cooperation. As the world works toward a post-2012 climate treaty, the twenty-year history of the Montreal Protocol offers invaluable lessons for climate negotiators and demonstrates the potential of international environmental law in the pursuit of sustainable development.[47]

Climate mitigation under the Montreal Protocol is one of several key strategies for achieving immediate climate mitigation, along with strategies for energy efficiency, reductions in black carbon, or soot, expansion of renewables, and enhancement and protection of forests and other sinks. These and other immediate mitigation strategies are needed to buy critical time to develop a sufficiently strong post-2012 climate regime.

It is impossible to say just how much the planet will warm before triggering abrupt climate changes, but critical thresholds could be as near as ten years away, and it is imperative to strengthen the Montreal Protocol to avoid every ton of CO_2e emissions that it can. In addition to finishing the job of protecting the ozone layer, this is one of the best insurance policies the world can buy to give us time to succeed with our long-term climate controls. And it is an insurance policy that we can be confident will be delivered by the world's best environmental treaty.

Endnotes: Landmark Agreement to Strengthen Montreal Protocol

[1] Eli Kintisch, *Tougher Ozone Accord Also Addresses Global Warming*, 317 Sci. 1843 (Sept. 2007).

[2] States that have not yet ratified the Montreal Protocol are Andorra, Holy See, Iraq, San Marino, and Timor Leste.

[3] *See* U.S. Envtl. Protection Agency, Analysis—Overall HCFC Agreement: Potential Climate Benefits of New Stronger HCFC Phaseout Controls, *available at* http://www.epa.gov/spdpublc/intpol/mpagreeanalysis.html (last visited Mar. 5, 2008). The climate benefits of the accelerated HCFC phase-out depend on the GWPs of the chemicals used as substitutes. The U.S. EPA calculated that a transition to zero or low GWP chemicals will result in a reduction of approximately 16 $GtCO_2e$ over the course of the phase-out. [hereinafter Overall HCFC Agreement]. Four independent calculations of the potential climate benefits were made in advance of the adjustment, ranging from 17.5 to 25.5 $GtCO_2$-eq. between 2010 and 2050; all noted that the estimates depended upon how carefully the transition our of HCFCs was managed to maximize climate benefits and energy efficiency. *See* Donald Kaniaru, Rajendra Shende, Scott Stone, & Durwood Zaelke, *Frequently Asked Questions: Strengthening the Montreal Protocol by Accelerating the Phase-Out of HCFCs at the 20th Anniversary Meeting of the Parties* in Celebrating the Montreal Protocol: 20 Years of Environmental Progress—Ozone Layer and Climate Protection (Donald Kaniaru ed., 2007).

[4] Correspondence with Dr. Guus J.M. Velders of the Netherlands Environmental Assessment Agency (on file with authors).

[5] *See* Stephen O. Andersen & K. Madhava Sarma, Protecting the Ozone Layer: The United Nations History (Earthscan 2002). *See also* Stephen O. Andersen, K. Madhava Sarma, & Kristen N. Taddonio, Technology Transfer for the Ozone Layer: Lessons for Climate Change (Earthscan 2007); The Montreal Protocol: Celebrating 20 Years of Environmental Progress: Ozone Layer and Climate Protection, (Donald Kaniaru, ed., Cameron 2007).

[6] World Meteorological Organization & UN Env't Programme, Science Assessment Panel of the Montreal Protocol on Substances that Deplete the Ozone Layer, *Scientific Assessment of Ozone Depletion: 2006* (2006).

[7] CFC and HCFC refrigerants are contained in some vehicle and stationary air conditioning systems that will be in service for many years to come. CFC and HCFC foam-blowing agents are contained in the thermal insulating foam of refrigerators and refrigerated cases and in building insulating foam. Halon fire extinguishing agents are contained in hand-held, wheeled and fixed fire suppression systems. CFCs, HCFCs, Halons, and other ODS are stockpiled by chemical speculators expecting price increases after phaseout and by product manufacturers left with excess supplies after conversion to ozone-safe alternatives. Although many countries prohibit the venting of ODS, numerous investigations have documented that owners often prefer to allow the chemicals to leak away rather than paying the costs of destruction.

Endnotes: Landmark Agreement to Strengthen Montreal Protocol
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[8] DAVID HUNTER, JAMES SALZMAN & DURWOOD ZAELKE, INTERNATIONAL ENVIRONMENTAL LAW & POLICY (3d ed., Foundation Press 2007).

[9] Conversation with Dr. Tolba (notes on file with authors).

[10] *See* UN ENV'T PROGRAMME, THE MONTREAL PROTOCOL CONTROL SCHEDULE AND ITS EVOLUTION (Oct. 2002), *available at* http://www.moef.gov.bd/html/env_bangladesh/data/schedule.pdf (last visited Mar. 7, 2008) (discussing the substances controlled under the Montreal Protocol and the date and matting when each Amendment and/or Adjustment was agreed upon).

[11] The London Amendment (1990), the Copenhagen Amendment (1992), the Montreal Amendment (1997), and the Beijing Amendment (1999).

[12] *See* 42 U.S.C. § 7671(9) (2008).

[13] UN Env't Programme, *1998 Assessment Report of the Technology and Economic Assessment Panel* (Oct. 1998), *available at* http://ozone.unep.org/teap/Reports/TEAP_Reports/index.shtml (last visited Mar. 5, 2008) ("HCFC global consumption is expected to decrease from 412 to 163 ktonnes between the years 1998 and 2015, respectively."). *See also* UN Env't Programme & Tech. Econ. Assessment Panel, *Response to Decision XVIII/12: Report of the Task Force on HCFC Issues and Emissions Reduction Benefits Arising from Earlier HCFC Phase-out and other Practical Measures,* at 25 (Aug. 2007), *available at* http://ozone.unep.org/Assessment_Panels/TEAP/Reports/TEAP_Reports/TEAP-TaskForce-HCFC-Aug2007.pdf (last visited Mar. 6, 2008) [hereinafter TEAP Accelerated HCFC Phase-Out Task Force Report]; UN Env't Programme, Intergovernmental Panel Climate Change & Tech. Econ Assessment Panel, *Special Report: Safeguarding the Ozone Layer and the Global Climate System: Issues Related to Hydroflurocarbons and Perfluorocarbons*, Technical Summary, at 81 (2005) ("In developing countries, the production of HCFC-22 for both feedstock and nonfeedstock uses has grown rapidly in recent years; over the period 1997–2001, production for commercial (or nonfeedstock) uses grew linearly at 20 ktonnes yr^{-1} and feedstock use grew at 4.1 ktonnes yr^{-1}. Projected at these rates until 2015, the total global requirement for HCFC-22 would become about 730 ktonnes yr^{-1}—about 40% of which would be for feedstock—compared with a total of 470 ktonnes yr^{-1} in the year 2000.").

[14] World Meteorological Organization & UN Env't Programme, Science Assessment Panel of the Montreal Protocol on Substances that Deplete the Ozone Layer, *Scientific Assessment of Ozone Depletion: 2006, Executive Summary,* at 21 (Aug. 2006), *available at* http://www.esrl.noaa.gov/csd/assessments/2006/executivesummary.html (last visited Mar. 5, 2008) ("The date when equivalent effective stratospheric chlorine at midlatitudes returns to pre-1980 levels is no calculated to be 2049, for the case of global compliance with the Montreal Protocol with no significant exceptions. This date is about 5 years later than projected in the previous (2002) assessment. This projected

later date primarily results from (i) an increase in CFC-11 and CFC-12 emissions due to the larger recent estimates of amounts currently contained in equipment and products (banks) and (ii) an increase in HCFC-22 emissions due to larger estimated future production. … The return to pre-1980 conditions of equivalent effective stratospheric chlorine for the Antarctic vortex is projected to occur around 2065, more than 15 years later than the return of midlattitude equivalent effective stratospheric chlorine to pre-1980 levels. This projected later recovery is because, unlike previous Assessments, we now recognize that the age of air is greater in the Antarctic lower stratosphere, which affects the amount of ozone-depleting gases available for ozone depletion. …").

15 Env't Investigation Agency, Turning Up the Heat: Linkages Between Ozone Layer Depletion and Climate Change: The Urgent Case of HCFCs and HFCs (Aug. 2006), *available at* www.eia-international.org/files/news324-1.pdf (last visited Mar. 7, 2008) [hereinafter Turning Up the Heat].

16 UN Env't Programme, *Supplement to the IPCC/TEAP Report* at 17, (Nov. 2005), *available at* www.ozone.unep.org/teap/Reports/TEAP_Reports/teap-supplement-ippc-teap-report-nov2005.pdf (last visited Mar. 7, 2008) ("Although mitigation of HFC-23 release is technically possible and economically attractive under the UNFCCC Clean Development Mechanism (CDM), the availability of funds through the sale of CDM credits obtained from the reduction of HFC-23 emissions could provide a perverse incentive for the continuation or expansion of HCFC-22 production in Article 5(1) countries in order to generate such credits.") [hereinafter IPCC/TEAP Supplement]. *See also* Turning Up the Heat *supra* note 15 ("The cost of destroying the HFC-23, however, is very low (around $0.20 per mt), allowing for extremely high profits.").

17 IPCC/TEAP Supplement, *supra* note 16, at 17; *see* Turning Up the Heat, *supra* note 15.

18 *See* UN Env't Programme, Intergovernmental Panel on Climate Change & Technology and Economic Assessment Panel, *Special Report: Safeguarding the Ozone Layer and the Global Climate System: Issues Related to Hydrofluro-carbons and Perfluorocarbons, Summary for Policymakers,* at 8 (2005).

19 TEAP Accelerated HCFC Phase-Out Task Force Report, *supra* note 13, at 6 ("Monies flowing from the sale of Certified Emission Reductions (CERs) could be up to 10 times higher than the costs of mitigation and, under expected future carbon prices, will exceed the sales revenue for the HCFC-22 itself."); Michael Wara, *Is the Global Carbon Market Working?* 445 Nature 595, 595-96 (2007) ("HFC-23 emitters can earn almost twice as much from CDM credits as they can from selling refrigerant gases—by any measure a major distortion of the market. The distortion exists because it is extremely cheap to cut HFC-23 emissions from these facilities."); IPCC/TEAP Supplement, *supra* note 16, at 7 ("Although mitigation of HFC-23 release is technically possible and economically attractive under the UNFCCC Clean Development Mechanism (CDM), the availability of funds through the sale of CDM credits obtained from the reduction of HFC-23 emissions could provide a perverse incentive for the continuation or expansion of HCFC-22 production in Article 5(1) countries in order to generate such credits."). *See Turning Up the Heat*, *supra* note 15, at 9 ("The cost of destroying the HFC-23, however, is very low (around $0.20 per mt), allowing for extremely high profits."); World Bank, States and Trends of the Global Carbon Market 2006, Update: January 1 – September 30, 2006, 11 (2006), *available at* www.carbonfinance.org/docs/StateandTrendsMarketUpateJan1_Sept30_2006.pdf (last visited Mar. 6, 2008) ("HFC-23 destruction projects continued to dominate with 52% of all project-based volumes transacted in 2006 (down from 64% in 2005, *see* Figure 6). The authors are aware of additional large transactions at advanced stages, so the remainder of the year should see the HFC-23 share remaining the same or even rise. Many buyers are keenly aware of the stiff competition for and the finite availability of this asset class beyond this year. . . ."). The HFC-23 projects also are squeezing out projects from developing countries involving renewable energy and energy efficiency and driving down the price of carbon credits in the European Union's Emissions Trading System, further reducing investment in needed energy reform. Finally, they may be canceling the benefit for the climate, by driving increased production of HCFC-22.

20 TEAP Accelerated HCFC Phase-Out Task Force Report, *supra* note 13, at 6 ("In extreme cases, it might even be possible that low HCFC-22 prices encourage the re-introduction of the chemical into foam applications in which it has already been replaced or as an aerosol propellant, where it has not been used widely before, or into other applications where environmentally superior technology is widely available.").

21 Developed countries were not experiencing increased use of HCFCs and for the most part had already made the transition to non-ozone-depleting substitutes, such as HFCs. The European Union completed its phase-out of virtually all HCFCs by 2004.

22 *Stockholm Group 3rd Meeting Report* at 4-5 (Feb. 2007), ("An accelerated phase-out of HCFCs is both possible and necessary, in light of the availability of alternatives, concerns over compliance, and the costs of late transitioning out of HCFCs. . . Given the concerns over projected HCFC production and consumption levels by 2015 as well as compliance with the 2016 freeze date by developing countries, an earlier freeze date should be considered to avoid increased production of HCFCs.") [hereinafter *Third Stockholm Group Meeting*].

23 The PNAS paper was spearheaded by the Co-Chair of TEAP and scientists from the Scientific Assessment Panel who realized that the co-benefits of ozone and climate protection were underappreciated by policymakers because the data had never been presented in ways that conveyed the extraordinary magnitude of the opportunity.

24 Guus J. M. Velders et al., *The Importance of the Montreal Protocol in Protecting Climate*, 104 Proceedings of the National Academy of Sciences 4814, 4815 (2007) (The 135 $GtCO_2$-eq. between 1990 and 2010 is an aggregated total, including direct and indirect effects), *available at* http://www.pnas.org/cgi/reprint/104/12/4814 (last visited Mar. 6, 2008); Correspondence with Dr. Guus Velders, on file with authors. The per year reduction is 11 $GtCO_2$-eq. yr^{-1} between 1990 and 2010. *See also Hearing on "Achievements and Opportunities for Climate Protection under the Montreal Protocol,"* Hearing Before the U.S. House Committee on Oversight and Government Reform, 2 (2007) (statement of Dr. Guus Velders, on the Dual Benefits of the Montreal Protocol: Protecting Ozone Layer and Climate).

25 Velders et al., *supra* note 24*,* at 4817.

26 Proposals were submitted by Argentina, Brazil, Iceland, Mauritania, Mauritius, the Federated States of Micronesia, Norway, Switzerland, and the United States. Argentina and Brazil submitted a joint proposal, as did Iceland, Norway, and Switzerland. *See* Keith Bradsher, *Coalition Urges Limits on Perilous Refrigerant,* Int'l. Herald Trib., Mar. 14, 2007, *available at* http://www.iht.com/articles/2007/03/14/business/warming.php (last visited Mar. 6, 2008).

27 UN Env't Programme, *Report of the Twenty-Seventh Meeting of the Open-ended Working Group of the Parties to the Montreal Protocol*, UNEP/OzL.Pro.WG.1/27/9 at 25 (June 2007), *available at* http://ozone.unep.org/meeting_Documents/oewg/27oewg/OEWG-27-9E.pdf (last visited Mar. 6, 2008). *See also, Third Stockholm Group Meeting, supra* note 22, at 4 ("An accelerated phase-out of HCFCs is both possible and necessary, in light of the availability of alternatives, concerns over compliance, and the costs of late transitioning out of HCFCs.").

28 G8 Summit in Heiligendamm, Germany, *Growth and Responsibility in the World Economy, Summit Declaration,* para. 59, (June 2007), ("We will also endeavour under the Montreal Protocol to ensure the recovery of the ozone layer by accelerating the phase-out of HCFCs in a way that supports energy efficiency and climate change objectives. In working together toward our shared goal of speeding ozone recovery, we recognize that the Clean Development Mechanism impacts emissions of ozone-depleting substances." *available at* http://www.state.gov/documents/organization/92264.pdf [hereinafter *G8 Summit Declaration*]. *See also* U.S.-Japan Joint Statement on Energy Security, Clean Development, and Climate Change, (Apr. 2007) ("We will also endeavor under the Montreal Protocol to ensure the recovery of the ozone layer to pre-1980 levels by accelerating the phase-out of HCFCs in a way that supports energy efficiency and climate change objectives."); U.S.-EU Summit Statement on Energy Security, Efficiency, and Climate Change, Apr. 2007 ("We also commit under the Montreal Protocol to seek to speed up the recovery of the ozone layer by accelerating the phase-out of HCFCs. We will weigh the impact of our proposals on climate change and energy efficiency. In working together toward our shared goal of speeding ozone recovery, we recognize that the Clean Development Mechanism impacts emissions of ozone-depleting substances.").

29 Mario Molina, *The Ozone Treaty Can Do Much More for the Planet*, FinancialTimes*,* Aug. 24 2007, *available at* http://www.ft.com/cms/s/0/ad5a4ba2-51da-11dc-8779-0000779fd2ac.html (last visited Mar. 6, 2008).

30 UN Env't Programme*, Open-ended Working Group of the Parties to the Montreal Protocol, Synthesis Report, UNEP/Oz.Pro.WG.1/27/3* at 6, (Feb. 22, 2007), *available at* http://ozone.unep.org/Meeting_Documents/oewg/27oewg/OEWG-27-2E.pdf (last visited Mar. 6, 2008). ("Technically and economically

feasible substitutes are available for almost all applications of HCFCs, although transitional costs remain a barrier for smaller enterprises, particularly in developing countries."). *See also Third Stockholm Group Meeting*, *supra* note 22, at 5 ("Alternatives exist for HCFCs in all applications. To capture climate benefits in transitioning out of HCFCs, alternatives should be evaluated in terms of their cumulative environmental impacts, such as under Life Cycle Analysis and Life Cycle Climate Performance, which would consider both direct impacts based on a substance's GWP and indirect impacts such as by-product emissions and GHG emissions from energy consumption."). *See also* Andersen & Sarma, *supra* note 5 at 201-02.

[31] *See* Press Release, U.S. Dep't of State, Accelerated Phase-Out of Ozone Depleting HCFCs (revised Oct. 16, 2007), *available at* http://www.state.gov/r/pa/prs/ps/2007/sep/92598.htm (last visited Mar. 10, 2008).

[32] *See* Overall HCFC Agreement, *supra* note 3.

[33] Decision XIX/6: Adjustments to the Montreal Protocol with regard to Annex C, Group I, substances (hydrochlorofluorocarbons), *available at* http://www.epa.gov/ozone/downloads/HCFCDecision.pdf (last visited Mar. 5, 2008).

[34] Philippe Sauvagnargues, *'Historic' deal reached on cutting ozone threats,* Agence-France Presse, Sept. 22, 2007.

[35] Institute for Governance & Sustainable Development, Strengthened Ozone Treaty Provides Powerful Climate Mitigation, Sept. 23, 2007, *available at* http://www.igsd.org/PressRelease23Sept.pdf (last visited Mar. 5, 2008).

[36] UN Env't Programme, *Report of the Ozone Secretariat Workshop on the IPCC/TEAP Special Report*, UNEP/OzL.Pro/Workshop.2/2 (July 2006), *available at* http://ozone.unep.org/teap/Reports/TEAPReports/Workshop2-2E.pdf (last visited Mar. 10, 2008). *See also* K. Madhava Sarma, *Strengthening the Montreal Protocol: The Step-by-Step Approach for the Montreal Protocol,* Chapter 14 (2006).

[37] TEAP Accelerated HCFC Phase-Out Task Force Report, *supra* note 13, at 10 ("The most advanced accelerated HCFC phase-out schedule combined with all other practical measures provides cumulative ozone-related savings of nearly 1.25 million ODP tonnes (*see* Figure ES-8) and in excess of 30 billion tonnes CO_2-eq of potential climate protection (*see* Figure ES-9).").

[38] IPCC/TEAP Supplement, *supra* note 15, at Annex.

[39] Emissions from banks of HFC substitutes used in refrigeration and air conditioning equipment also will be emitted, as HFCs have been among the leading substitutes for CFCs.

[40] Velders, *et al*., *supra* note 24, at 4818 (". . . parties to the Montreal Protocol have considered options to further mitigate ozone depletion while incident ally reducing climate forcing. Some import ant examples are the following: (i) further acceleration of the HCFC phase-out (8, 41) and use of low-GWP substitutes; (ii) collection and destruction of ODSs contained in ''banks'' of old refrigeration, air conditioning equipment, and thermal insulating foam products (8, 42, 43); and . . .").

[41] *See* About Us, Refrigerant Reclaim Australia website, http://www.refrigerantreclaim.com.au (last visited Mar. 5, 2008) ("Refrigerant Reclaim Australia (RRA) is the product stewardship organisation for the Australian refrigeration and air conditioning industry. RRA is a not-for-profit organisation created to work nationally with industry to share the responsibility for, and costs of, recovering, reclaiming and destroying surplus and unwanted refrigerants. RRA's aim is to improve the industry's environmental performance by reducing the level of emissions of refrigerants through its take-back program. Since established in 1993, RRA has become part of the industry fabric. Created by industry, for industry, RRA is a best-practice, producer responsibility organisation. RRA: adopts a co-regulatory approach, which produces positive environmental outcomes; operates efficiently through one coordinated scheme, saving industry members time, money and effort; and provides rebates for contractors who recover and return refrigerant (around $1.3 million in 2005/2006)."). *See also* The Global Climate and Ozone Layer Protection Act of 2007, H.R. 3448, 110th Cong. (2007) (introduced by Congressman Henry A. Waxman and providing for a similar program to promote greater recovery and recycle/destruction of used refrigerants). The bill also recognizes the climate benefits of the Montreal Protocol to date and includes a sense of Congress resolution directing the U.S. to negotiate with other Parties to maximize the climate benefits of the accelerated HCFC phase-out, "by focusing on the climate impacts of ozone depleting substances and their substitutes, and on the energy efficiency of equipment in which such substances and their substitutes are used"; America's Climate Security Act of 2007, S.2191, 110 Cong. (2007). Introduced by Senators Lieberman and Warner and reported out of the Senate's Environment and Public Works Committee in December 2007 also provides for some ODS recovery.

[42] *See* Ozone Depleting Substance Destruction Emissions Offsets, Chicago Climate Exchange, *available at* http://chicagoclimateexchange.com/docs/offsets/CCX_Ozone_Depleting_Substance_Destruction_Offsets.pdf (last visited Mar. 18, 2008).

[43] For example, the use of HCFC-123 in chillers achieves superior energy efficiency than alternatives. But because it is an ozone-depleting substance, it is scheduled for phase-out with the rest of the HCFCs. Continued use of HCFC-123 in chillers would benefit the climate by reducing the energy consumption from chillers. *See* Stephen Andersen & Durwood Zaelke, Industry Genius: Inventions and People Protecting the Climate and the Fragile Ozone Layer (Greenleaf 2003).

[44] Stephen Johnson, Administrator, U.S. Envtl. Protection Agency, Remarks to the 19th Meeting of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer, Montreal, Canada (Sept. 17, 2007), *available at* http://yosemite.epa.gov/opa/admpress.nsf/Speeches%20-%20By%20Date?OpenView (last visited Mar. 10, 2008).

[45] Donald Kaniaru, Rajendra Shende, Scott Stone & Durwood Zaelke, *Strengthening the Montreal Protocol: Insurance Against Abrupt Climate Change*, Sustainable Dev. L. & Pol'y, Winter 2007, at 3.

[46] The GREEN MAC LCCP model was developed by General Motors, the Japanese Automobile Manufacturers Association, the Society of Automotive Engineers, and the U.S. Environmental Protection Agency to calculate the lifecycle climate performance of mobile air conditioners with different refrigerants. *See* U.S. EPA, Climate Protection Partnership website, http://www.epa.gov/cpd/mac/compare.htm (last visited Mar. 18, 2008).

[47] Institute for Governance & Sustainable Development, Montreal Protocol's Key Lessons for Climate Negotiations (Dec. 4, 2007), *available at* http://www.igsd.org/Lessons-of-the-Montreal-Protocol-for-Climate.pdf (last visited Mar. 18, 2008).