Opportunities to Achieve Fast-Action Climate Change Mitigation through the Montreal Protocol

On April 30, 2009, the Federated States of Micronesia and Mauritius submitted a joint proposal to amend the Montreal Protocol on Substances the Deplete the Ozone Layer ("Montreal Protocol") that, if successful, will achieve climate change mitigation several times greater than the emission reductions achieved under the first commitment period of the Kyoto Protocol to the United Nations Framework Convention on Climate Change (respectively, "Kyoto Protocol" and "UNFCCC") at a fraction of the cost.[1] The joint proposal seeks to regulate hydrofluorocarbons ("HFCs") under the Montreal Protocol and explore regulatory and financing options to address banks of ozone-depleting substances ("ODSs")—that are also powerful greenhouse gases ("GHGs")—including exploring whether or not preventing emissions of ODSs from banks can be co-financed through carbon markets and other financial mechanisms under the UNFCCC.

HFCs

HFCs are powerful GHGs[2] produced primarily for use as replacements in applications that originally used ODSs that are being phased-out under the Montreal Protocol or as a byproduct of ODS production.[3] Because HFCs are GHGs and not ODSs, they were included within the basket of GHGs regulated under the Kyoto Protocol and are not controlled by the Montreal Protocol.[4]

Although alternatives are commercially available in some sectors and under development in others, under the Kyoto Protocol, HFC emissions have increased approximately 15% per year and will increase dramatically over the coming years and decades as the ODSs they replace are phased-out under the Montreal Protocol.[5] While HFC emissions currently only contribute 1-2% of the radiative forcing of all well-mixed GHGs on a 100-year global warming potential ("GWP") basis, their contribution is projected to potentially increase to up to 30% by 2040 under a carbon-dioxide ("CO_2") stabilization scenario of 450 ppm.[6] Further, most HFCs have a short atmospheric lifetime, meaning their 20-year GWP is greater than the 100-year GWP used by the Intergovernmental Panel on Climate Change ("IPCC") to calculate CO_2-eq.[7] Consequently, the near- and mid-term impact of HFCs is greater than their 100-year GWP would indicate, as is the near- and mid-term potential climate change mitigation available from reducing HFC emissions.

Current estimates project that preventing the emission of high-GWP HFCs through a production and consumption phase-down has a climate mitigation potential of between 5.3 to 19.7 billion tonnes ("Gt") CO_2-equivalent ("CO_2-eq.") by 2030 (between 1.3 to 3.3 Gt CO_2-eq. per year by 2030) and between 52.2 to 171.6 Gt CO_2-eq. by 2050 (3.3 to 12.9

Gt CO_2-eq. per year by 2050).[8] In order to maximize the climate benefits and minimize the costs of phasing-down high-GWP HFCs, a regulatory framework must be developed, agreed upon, and implemented as quickly as possible utilizing all available international institutions and agreements. Among international institutions, the Montreal Protocol has a particularly important role to play in reducing the climate impact of HFCs.

HFCs, like ODSs, are synthetic GHGs generally produced as products themselves—as opposed to naturally occurring GHGs produced as byproducts of industrial processes like CO_2. By and large, HFCs are produced for use as substitutes for ODSs in the sectors regulated under the Montreal Protocol.[9] Regulating high-GWP HFCs is also essential to preserving the climate change mitigation benefits of the 2007 accelerated phase-out of Hydrofluorocarbons ("HCFCs") under the Montreal Protocol—which has the potential to prevent 16 Gt CO_2-eq. emissions by 2040[10]—by ensuring the substances that replace HCFCs are as climate friendly as possible.[11] The experience of the Montreal Protocol has also shown that it is far more cost-effective to prevent emissions in these sectors upstream, by regulating production and consumption, than it is to regulate emissions downstream after these chemicals are placed onto the market or at end-of-life.[12]

The Montreal Protocol is also the only international institution with the experience, expertise, and institutions already in place to quickly implement a HFC phase-down. The Montreal Protocol has achieved near-universal ratification and equitably imposes reduction commitments for developed and, following a grace period, developing countries. It also has a trusted and effective financial transfer mechanism, the Multilateral Fund ("MLF"), and effective technology transfer mechanism. Commitments under the Montreal Protocol are enforceable and implementation is carried out through a network of trained national ozone officers in nearly every developing. The treaty is supported by real-time scientific and technical data and analysis from the Scientific Assessment Panel ("SAP"), Technical and Economic Assessment Panel ("TEAP"), and Technical Options Committees ("TOCs") which the Parties utilize to tighten their restrictions regularly through "adjustments" that can be effectuated by decision.

The Montreal Protocol is responsibility for the proliferation of HFCs. HFCs are primarily used as replacements for ODSs that are being phased-out under the Montreal Protocol and the MLF has financed the transition from ODSs to HFCs in developing countries. The Montreal Protocol has a legal mandate, indeed, an obligation, to ensure that the chemicals that replace ODSs are as environmentally, and climate, friendly as possible.[13] The Kyoto Protocol only regulates HFC emissions and there exists a dangerous regulatory void where no international treaty regulates HFC production and consumption—the point in the life-cycle of these chemicals where it is the easiest and most cost-effective to reduce emissions. Complementing the regulation of HFC emissions under the Kyoto Protocol or other post-2012 agreement by regulating production and consumption under the Montreal Protocol is therefore the best economic and environmental option for this particular GHG and critical to achieving fast-action climate change mitigation.

ODS Banks

The Montreal Protocol currently only regulates production and consumption, meaning once an ODS is released onto the market it is no longer controlled under the Montreal Protocol. Over years and decades, banks of unwanted ODSs have accumulated in existing stockpiles and discarded products and equipment. The TEAP and IPCC estimate that ODS banks contain approximately 20 Gt CO_2-eq. across all sectors worldwide.[14] Emissions of ODSs from banks will have a significant climate change impact in the near- and mid-term. If over the next two decades the emission of all ODSs in banks were prevented, the direct positive radiative forcing avoided would be equal to approximately 3 – 4% of the total radiative forcing from all anthropogenic GHG emissions over the same period.[15] Of immediate concern, are ODS banks in sectors identified as the most cost-effective to recover and destroy and that will also emit the vast majority of their ODSs by 2015.[16] Without immediate action, these banks found in existing stockpiles, refrigeration, stationary air conditioning ("SAC"), and mobile air conditioning ("MAC") will emit approximately 6 Gt CO_2-eq. by 2015[17]—offsetting the 5 Gt CO_2-eq. emission reductions sought during the initial commitment period of the Kyoto Protocol.[18]

Emissions of ODSs from banks are *not* controlled by the Montreal Protocol—which only controls the production and consumption of ODSs—nor are these powerful GHGs targeted for reductions under the Kyoto Protocol.[19] In order to prevent emissions from ODS banks in both developed and developing countries, the international community must act swiftly to close this legal loophole.

Several industrialized countries have already demonstrated that recovering and destroying "reachable" ODS banks can be accomplished efficiently and cost-effectively.[20] This year's joint proposed amendment seeks to mandate the recovery and destruction of ODS banks in industrialized countries in certain sectors through an amendment to the Montreal Protocol.[21] With respect to developing countries, the principal obstacle to ODS bank destruction is financing.[22]

Absent immediate action and funding the most cost-effective banks in developing countries will emit 2-3 Gt CO_2-eq. by 2015.[23] Further, a significant amount of the ODSs in banks currently not considered cost-effective based on their ozone benefits alone—an additional 14 Gt CO_2-eq. worldwide—are cost-effective to recover and destroy based on are climate benefits.[24] Financing the recovery and destruction of ODS banks in developing countries can be achieved through a supplemental replenishment to the MLF. But this funding should be complemented by additional funding from the financial mechanisms under the UNFCCC, including carbon markets where it is environmentally beneficial to do so and will not undermine the integrity or utility of the CDM and its successor. The agreed outcome of negotiations under the UNFCCC should include special provision providing such financing, given this is a cost-effective opportunity to mitigate climate change. Recovering and destroying "reachable" banks will deliver near-term climate change mitigation at a fraction of the cost of many other mitigation measures, while also providing cost-effective ozone layer protection, and can be done in

a way that transforms and strengthens existing institutions to ensure the maximum climate benefits are achieved.

Destroying 1 CO_2-eq. tonne of ODSs in many banks—equal to 1 Certified Emissions Reduction ("CER") under the CDM—can be accomplished, in many instances, at a cost of less than US$ 5.[25] As of February 2009, CERs during the first commitment period were valued on the European Union Emissions Trading Scheme ("EU ETS") at over US$ 15—after peaking at over US$ 30 in mid-2008—with the price of CERs predicted to increase in the coming years as new carbon markets emerge and linkages are established.[26] This means ODS bank destruction can prevent the emission CO_2-eq. tonne at a fraction of the price of many other mitigation options. Thus, if managed properly, ODS bank destruction offers an opportunity to deliver cost-effective fast-action climate change mitigation and ozone layer protection.

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[1] Proposed Amendment to the Montreal Protocol (submitted by the Federated States of Micronesia and Mauritius) (2009) [hereinafter 2009 HFC Amendment], at 17-19, http://ozone.unep.org/Meeting_Documents/oewg/29oewg/OEWG-29-8E.pdf. On May 4, 2009, the United States submitted a letter to the Ozone Secretariat commenting on the proposed amendment. Letter from Dan Reifsnyder, Deputy Assistant Secretary, Environment and Sustainable Development, United States Department of State, to Marco Gonzalez, Ozone Secretariat, United Nations Environment Programme (4 May 2009), http://ozone.unep.org/Meeting_Documents/oewg/29oewg/letter_from_USA_on_HFCs.pdf.

[2] *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE [IPCC] AND TECHNOLOGY AND ECONOMIC ASSESSMENT PANEL [TEAP], IPCC/TEAP SPECIAL REPORT ON SAFEGUARDING THE OZONE LAYER AND THE GLOBAL CLIMATE SYSTEM: ISSUES RELATED TO HYDROFLUOROCARBONS AND PERFLUOROCARBONS (2005) [hereinafter IPCC/TEAP 2005 SPECIAL REPORT] at *Summary for Policymakers* at 8 (listing the 100-year GWP of the most common HFCs as ranging from 122 to 14,310), http://arch.rivm.nl/env/int/ipcc/docs/full-reports/SROC-FullVolumev2.pdf.

[3] *See generally* Montreal Protocol on Substances That Deplete the Ozone Layer, *opened for signature* Sept. 16, 1987, 26 I.L.M. 1550 (1989) (as amended 32 I.L.M. 84) (1992) [hereinafter Montreal Protocol]. The major applications using ODSs and their HFC substitutes include the refrigeration, air conditioning, insulating foams, aerosols, fire protection and solvents sectors. *See supra* note 2, IPCC/TEAP 2005 SPECIAL REPORT at *Summary for Policymakers* at 4. HFC-23—a super-GHG—is produced as a byproduct of the production of HCFC-22. *See* ENVIRONMENTAL INVESTIGATION AGENCY, TURNING UP THE HEAT: LINKAGES BETWEEN OZONE LAYER DEPLETION AND CLIMATE CHANGE: THE URGENT CASE OF HCFCS AND HFCS (2006), http://www.eia-global.org/PDF/Report--TurningUpHeat--Climate--Aug06.pdf.

[4] *See* Kyoto Protocol to the United Nations Framework Convention on Climate Change, *opened for signature* March 16, 1998, U.N. Doc FCCC/CP/1997/7/Add.1, 37 I.L.M. 22 (1998) [hereinafter Kyoto Protocol] at Annex A.

[5] *See supra* note 2, IPCC/TEAP 2005 SPECIAL REPORT at *Summary for Policymakers* at 5; TEAP, *Advance Copy* ASSESSMENT OF ALTERNATIVES TO HCFCS AND HFCS AND UPDATE OF THE 2005 SUPPLEMENT REPORT DATA (2009) [hereinafter TEAP ADVANCE HFC REPORT], http://ozone.unep.org/Assessment_Panels/TEAP/Reports/TEAP_Reports/teap-may-2009-decisionXX-8-task-force-report.pdf.

[6] *See supra* note 2, IPCC/TEAP 2005 SPECIAL REPORT at *Summary for Policymakers* at 6; *supra* note 4, TEAP ADVANCE HFC REPORT; Mack McFarland, *Potential Climate Benefits of a Global Cap and Reduction Agreement for HFCs*, (18 Nov. 2008) (unpublished research presented at the 20th Meeting of the Parties to the Montreal Protocol in Doha, Qatar) (on file with author) (comparing HFC emissions growth rates to CO_2 emissions under different stabilization scenarios). These estimates assume a business-as-usual scenario HFC consumption growth rate of 1-3% in developed countries and 3-6% in developing countries.

[7] *See* P. FORSTER & V. RAMASWAMY ET AL., IPCC, *Changes in Atmospheric Constituents and Radiative Forcing*, *in* CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS, CONTRIBUTION OF WORKING GROUP I TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

[hereinafter AR4 THE PHYSICAL SCIENCE BASIS] 212 (S. Solomon et al. eds., 2007). For example, HFC-134a, which is predicted to account for 50-55% of radiative forcing due to HFCs by mid-century, has an atmospheric lifetime of just 14 years and a 20-year GWP of 3,830, compared to its 100-year GWP of 1,430. *Id.* at 164.

[8] *See supra* note 6, Mack McFarland, *Potential Climate Benefits of a Global Cap and Reduction Agreement for HFCs*, (18 Nov. 2008) (unpublished research presented at the 20th Meeting of the Parties to the Montreal Protocol in Doha, Qatar) (on file with author). The assumed HFC phase-down schedule sets the baseline as the average production and import of HFCs, on a 100-year GWP-weighted basis, from 2004 – 2006, and calls for production and import levels to decrease from the baseline amount to 69-93% by 2012, 52-70% by 2020, 37-50% by 2025, 22-30% by 2030, 18-25% by 2035, and 15-20% by 2040, with a 10-year grace period for developing countries. Further climate savings beyond these estimates are possible if a more aggressive phase-down schedule, as was proposed in the 2009 HFC Amendment, is adopted. *See supra* note 1, 2009 HFC Amendment at 17-19.

[9] *See supra* note 3 and accompanying text.

[10] *See* Montreal Protocol, Report of the Nineteenth Meeting of the Parties to the Montreal Protocol, Montreal, Canada (2007) [hereinafter Report of the 19th MOP], at Decision XIX/6 (accelerating the phase-out of HCFCs); U.S. EPA, *2008 Climate Award Winners*, (July 10, 2008) (providing estimates of the climate change mitigation potential of the 2007 HCFC accelerated phase-out), http://www.epa.gov/cppd/awards/2008winners.html (last accessed Jan. 6, 2009).

[11] *See* TEAP, RESPONSE TO DECISION XVIII/12, REPORT OF THE TASK FORCE ON HCFC ISSUES (WITH PARTICULAR FOCUS ON THE IMPACT OF THE CLEAN DEVELOPMENT MECHANISM) AND EMISSIONS REDUCTIONS BENEFITS ARISING FROM EARLIER HCFC PHASE-OUT AND OTHER PRACTICAL MEASURES (2007) [hereinafter TEAP RESPONSE] at 8, http://ozone.unep.org/teap/Reports/TEAP_Reports/TEAP-TaskForce-HCFC-Aug2007.pdf.

[12] This is particularly true for ODSs and HFCs in insulating foam banks where the cost of preventing emissions after installation is, in some cases, prohibitively expensive. *See* TEAP, REPORT OF THE TASK FORCE ON FOAM END-OF-LIFE ISSUES – VOLUME 3 (May 2006), at 6, http://ozone.unep.org/teap/Reports/TEAP_Reports/TEAP-May-2005-Vol-2-Forms-End-of-Life.pdf.

[13] *See* Vienna Convention for the Protection of the Ozone Layer, *opened for signature* Mar. 22, 1985, 1513 U.N.T.S. 293 at Art. 2. The adoption of an amendment regulating HFCs is consistent with the General Obligations of the Parties to the treaty set forth in Article 2. Article 2(2)(b) states: "To this end the Parties shall … Adopt appropriate legislative or administrative measures and co-operate in *harmonizing appropriate policies to control, limit, reduce or prevent human activities under their jurisdiction or control should it be found that these activities have or are likely to have adverse effects resulting from modification or likely modification of the ozone layer* …" One of the principal justifications for regulating HFCs under the Montreal Protocol is to *harmonize* the regulation of the chemicals used in the sectors regulated by the Montreal Protocol. It is the *activities* under the Montreal Protocol, regulation and phase-out of CFCs and HCFCs, that has driven the increase in production, consumption, and emissions of HFCs. The MLF has also funded projects to replace CFCs and HCFCs with HFCs as part of its ongoing assistance Article 5 Parties to achieve compliance with their obligations to phase-out CFCs and HCFCs under the Montreal Protocol. While HFCs are not ODSs, they are powerful GHGs and are causing climate change, which undoubtedly qualifies as "adverse effects" as that term is defined under the Ozone Convention: "'Adverse effects' means changes in the physical environment or biota, *including changes in climate*, which have significant deleterious effects on human health or on the composition, resilience and productivity of natural and managed ecosystems, or on materials useful to mankind." *Id.* at Art. 1(2). While the production, consumption, and emission of CFCs, HCFCs, and other ODSs modify the ozone layer by causing ozone depletion, the phase-out of CFCs, HCFCs, and other ODSs also constitutes a *modification of the ozone layer* by accelerating its recovery. These *activities* are *resulting* in the proliferation of HFCs which is *causing adverse effects* because HFCs are GHGs that contribute to climate change, and therefore *harmonizing* policies under the Montreal Protocol to ensure an environmentally sound transition away from ODSs by regulating HFCs falls squarely within the scope of Article 2(2)(b). Previously, the Parties to the Montreal Protocol have exercised their broad authority under Article 2(2)(b) to regulate and prevent the use of toxic ODS substitutes that are toxic to the environment.

[14] *See* IPCC/TEAP 2005 SPECIAL REPORT, *supra* note 2, at 9.

[15] *Id.* at 136.

[16] *See* EXECUTIVE COMMITTEE OF THE MULTILATERAL FUND FOR IMPLEMENTATION OF THE MONTREAL PROTOCOL, REPORT OF THE MEETING OF THE EXPERTS TO ASSESS THE EXTENT OF CURRENT AND FUTURE REQUIREMENTS FOR THE COLLECTION AND DISPOSITION OF NON-REUSABLE AND UNWANTED ODS IN ARTICLE 5 COUNTRIES (FOLLOW UP TO DECISION 47/52) (2006) [hereinafter MLF FOLLOW UP REPORT] at 13, http://www.multilateralfund.org/files/48/4842.pdf; ICF INTERNATIONAL, STUDY ON THE COLLECTION AND TREATMENT OF UNWANTED OZONE-DEPLETING SUBSTANCES IN A5 AND NON-A5 COUNTRIES (2008) [hereinafter MLF 2008 REPORT] at 11-12, http://ozone.unep.org/Meeting_Documents/oewg/28oewg/ICF_Study_on-Unwanted_ODS-E.pdf.

[17] The TEAP has provided estimates of refrigeration, SAC, and MAC banks in developed and developing countries in 2002 and 2015. Based on these estimates of the reductions to reachable banks over the period 2002 to 2015, emissions from these banks in non-Article 5 Parties, i.e., developed countries, will be at least 194,038 tonnes of chlorofluorocarbons ("CFCs") and 454,887 tonnes of HCFCs. In Article 5 Parties, i.e., developing countries, "reachable" banks of CFCs will be reduced by 264,972 tonnes of CFCs from 2002 to 2015. Estimates of HCFC reductions from banks in Article 5 Parties are more difficult to discern based on TEAP figures because these banks will grow over the period from 2002 to 2015 by 737,931 tonnes, making estimates of emissions, calculated based on reductions in banks, difficult during this period. The available HCFC bank in these sectors during the period 2009 to 2015 is likely greater than one million tonnes. Estimates of HCFC emissions from banks in non-Article 5 Parties and CFC emissions from banks in Article 5 Parties during this period based on reductions in these banks also underestimate the total emissions because non-Article 5 Parties can continue to produce and consume HCFCs during this period, albeit at a reduced rate over time, and Article 5 Parties can continue to produce and consume CFCs until 2010. *See* TEAP, RESPONSE TO DECISION XVIII/12, REPORT OF THE TASK FORCE ON HCFC ISSUES (WITH PARTICULAR FOCUS ON THE IMPACT OF THE CLEAN DEVELOPMENT MECHANISM) AND EMISSIONS REDUCTIONS BENEFITS ARISING FROM EARLIER HCFC PHASE-OUT AND OTHER PRACTICAL MEASURES (2007) [hereinafter TEAP RESPONSE] at 27 (giving estimates of ODS banks in tonnes of ODS), http://ozone.unep.org/teap/Reports/TEAP_Reports/TEAP-TaskForce-HCFC-Aug2007.pdf. Readily available stockpiles of ODS banks also exist in nearly all countries. *See* MLF 2008 REPORT, *supra* note 16, at 11-12; *see also* MLF FOLLOW UP REPORT, *supra* note 16, at 19-24 (estimating that 514,653 tonnes of CFCs, approximately 5.45 Gt CO_2-eq., will be available for recovery and destruction in "reachable" banks in Article 5 Parties worldwide in 2010 and decreasing to 375,469 tonnes, approximately 4 Gt CO_2-eq., in 2015).

Estimates of CO_2-eq. have been calculated based on the global warming potential ("GWP") of CFC-12 (10,600) and HCFC-22 (1,700), the most common refrigerants found in refrigeration, SAC, and MAC banks. *See See* P. FORSTER & V. RAMASWAMY ET AL., INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE [IPCC], *Changes in Atmospheric Constituents and Radiative Forcing*, *in* CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS, CONTRIBUTION OF WORKING GROUP I TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE [hereinafter AR4 THE PHYSICAL SCIENCE BASIS] 212 (S. Solomon et al. eds., 2007) (setting forth the GWP of CFC-12 and HCFC-22); IPCC/TEAP 2005 SPECIAL REPORT, *supra* note 2, at *Technical Summary* at 53-63 (listing the most common ODSs by sector). The TEAP has stated that "[e]nd-of-life measures [across all sectors] are consistent and significant contributors to savings in terms of … climate, with cumulative savings of around … 6 [Gt] CO_2-eq." *See* TEAP RESPONSE, *supra* note 17, at 12. It is hoped that the report from the TEAP requested in Decision XX/7, and scheduled for presentation to the Parties by June 2009, will provide more up-to-date and accurate estimates of "reachable" banks. *See* Montreal Protocol, Report of the Eighth Meeting of the Conference of the Parties to the Vienna Convention and Twentieth Meeting of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer, U.N. Environment Programme (2008) [hereinafter Report of the 20th MOP], at Decision XX/7.

[18] The Kyoto Protocol's emissions reduction target, in terms of CO_2-eq., is -5.8 percent of a baseline of 18.4 Gt CO_2-eq. or -0.97 Gt CO_2-eq. per year by 2008–2012, roughly 5 Gt CO_2-eq. during the 2008-2012 commitment period. *See* Guus J.M. Velders, et al., *The importance of the Montreal Protocol in protecting climate*, 104 PROC. NAT'L. ACAD. SCI. 4814, 4818 (2007).

[19] *See generally* Montreal Protocol, *supra* note 3; *see also* Montreal Protocol, Report of the Thirteenth Meeting of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer, U.N. Environment Programme, at Decision XV/9 (2004) ("To recall that the Montreal Protocol does not require

the Parties to destroy ozone depleting substances."); *see also* Kyoto Protocol, *supra* note 4 at Art. 3 & Annex A.

[20] For example, Australia has implemented a producer responsibility program for bulk ODS disposal of refrigeration and SAC banks, Refrigerant Reclaim Australia ("RRA"). RRA has been immensely successful and financially self-sufficient. Run by industry and funded by levies placed on the production and import of virgin and reclaimed ODSs, RRA provides a rebate on the return of used refrigerant. The levies and rebates apply to all fluorocarbons, including HFCs, ensuring RRA remains capable of handling all refrigerants as industry moves from using CFCs to HCFCs to HFCs and other alternatives. RRA was originally an all-volunteer program, but is now mandated by law. However, Australia's program does not mandate the collection of foams in these applications which would increase the resulting ozone and climate benefits using existing governance institutions and infrastructure. *See* Refrigerant Reclaim Australia, http://www.refrigerantreclaim.com.au/ (last accessed Feb. 3, 2009); *see also* MLF 2008 REPORT, *supra* note 16, at 61-76.

Japan has mandated the recovery and destruction of "reachable" ODS banks in several sectors. In addition to laws mandating the recovery and destruction of ODSs in commercial refrigeration and SAC banks, in 2005 Japan also passed the End-of-Life Vehicle Recycling Law mandating the recovery and destruction of ODSs in MAC banks in vehicles. In response, industry has implemented a recycling program under which end-of-life vehicles are sent to registered recovery operators, who recover ODSs and are paid based on the number of MACs and quantity of refrigerant recovered. The costs of recovery and destruction are borne by vehicle owners at the time of purchase, i.e., incorporated into the cost of purchasing new vehicles. *See* MLF 2008 REPORT, *supra* note 16, at 106-20. Like RRA, this program has also been immensely successful and cost-effective.

Several European Community (EC) member states have enacted laws in response to EC Regulation 2037/2000 that require the recovery and destruction of ODSs from domestic refrigeration and SAC banks. Germany exceeds the requirements of Regulation 2037/2000 in many ways and requires ODSs in foams in these banks to be recovered as well. *See* MLF 2008 REPORT, *supra* note 16, at 97-105.

[21] A significant amount of ODS banks exist in all non-Article 5 Parties, where recovery and destruction rates vary widely. It is estimated that approximately 2 – 3 Gt CO_2-eq. will be emitted from reachable banks in non-Article 5 Parties by 2015. *See supra* note 17. While certain non-Article 5 Parties have demonstrated that the recovery and destruction of reachable banks can be achieved in a cost-effective manner, no non-Article 5 Party is implementing all available best practices across all sectors. The Parties should amend the Montreal Protocol to require non-Article 5 Parties recover and destroy a certain amount of ODS in "reachable" banks. These requirements should be based on the experiences of those countries already implementing recovery and destruction programs. The level of required ODS bank recovery and destruction should be achievable and cost-effective when compared to other climate mitigation measures. The amount of ODS required to be recovered by non-Article 5 Parties can be set on a per sector basis, or aggregated across all "reachable" banks to allow the Parties flexibility to pursue destruction based on their individual circumstances and the availability and cost-effectiveness of recovery and destruction in their country. It can also be linked to essential and critical use exemptions, requiring non-Article 5 Parties destroy a certain amount fo ODS banks in order to receive their essential and critical use exemptions. If necessary, to assist non-Article 5 Parties and provide incentives for the recovery and destruction of reachable ODS banks, supplemental funding may be created by harnessing the climate mitigation benefits of ODS bank destruction through voluntary carbon markets. One example, the Chicago Climate Exchange, has already approved a methodology for ODS bank destruction. *See* CHICAGO CLIMATE EXCHANGE, CCX OZONE-DEPLETING SUBSTANCES DESTRUCTION OFFSETS (2008), http://www.chicagoclimatex.com/docs/offsets/CCX_Ozone_Depleting_Substance_Destruction_Offsets.pdf

[22] "Article 5 Parties" are Parties operating under paragraph 1 of Article 5 of the Montreal Protocol and are generally considered "developing countries." *See* Montreal Protocol, *supra* note 3, at Art. 5(1). These Parties receive financial and technical assistance from developed countries via the MLF to meet their compliance obligations under the Montreal Protocol. *See* Montreal Protocol, *supra* note 3, at Art. 10.

[23] *See supra* note 17.

[24] In the mid-term, the 14 Gt CO_2-eq. in ODS banks worldwide that are currently not "reachable," i.e., not cost-effective based on their ozone benefits alone when compared to other measures traditionally funded by

the MLF, will become less expensive to recover and destroy using the infrastructure and expertise developed to recover and destroy "reachable" banks in the near-term. An increase in the price of CERs on carbon markets will also make recovering and destroying these ODS banks a more economically attractive ozone and climate mitigation option. The vast majority these ODS banks will be emitted before 2050. *See* IPCC/TEAP 2005 SPECIAL REPORT, *supra* note 2, at *Technical Summary* at 68.

[25] ODS destruction costs using TEAP approved destruction technologies ranges from US$ 2.75-11 per kg. *See supra* note 15. CFC-12, the most common CFC refrigerant found in reachable banks, can therefore be destroyed at a cost of between US$ .25-1 per tonne of CO_2-eq. because of CFC-12's high GWP of 10,600. *See supra* note 17. Estimating that CFC-12 can be recovered and destroyed at a cost of US$ 5 per tonne of CO_2-eq. assumes that destruction costs will be between 5-20% of the total costs (i.e., recovery + storage + transport + destruction).

[26] *See* European Climate Exchange, http://www.europeanclimateexchange.com/default_flash.asp (last visited Feb. 4, 2009). The current price per CER in US$ is less than half the price per CER in mid-2008, and significantly lower than the average price per CER in US$ throughout 2008, due to the global recession and the dramatic increase in the value of US$ against the Euro. *See* James Kanter, *Carbon Prices Tumble as Global Downturn Bites*, N.Y. TIMES (Jan. 21, 2009). However, CER prices should recover with the global economy and the expansion of carbon markets. Future prospects for carbon markets are promising, as the European Union has formally proposed that the United States join a common global carbon market. *See* Commission of the European Communities, COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS, TOWARDS A COMPREHENSIVE CLIMATE CHANGE AGREEMENT IN COPENHAGEN (2009), http://ec.europa.eu/environment/climat/pdf/future_action/communication.pdf.