Institute for Governance & Sustainable Development*

FREQUENTLY ASKED QUESTIONS ABOUT REGULATING HYDROFLUOROCARBONS UNDER THE MONTREAL PROTOCOL

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INTRODUCTION

Strengthening the Montreal Protocol on Substances that Deplete the Ozone Layer ("Montreal Protocol") to control and phase-down the production and consumption of hydrofluorocarbons ("HFCs") will provide fast-action climate mitigation to complement long-term efforts to reduce greenhouse gas ("GHG") emissions under the United Nations Framework Convention on Climate Change ("UNFCCC"). Quickly phasing-down HFCs is also necessary to avoid tipping points for abrupt, irreversible, and catastrophic climate changes and other "dangerous anthropogenic interference with the climate system."[1]

Actions taken pursuant to the Montreal Protocol have dramatically increased the demand for HFCs. In independent analyses published this year by the Technical and Economic Assessment Panel ("TEAP") and in the Proceedings of the National Academy of Sciences, leading scientists confirm that unless an international production and consumption phase-down of HFCs is implemented in the near-term, HFC emissions will increase dramatically and undermine efforts to curb the long-term driver of climate change—carbon-dioxide ("CO_2") emissions.[2] These analyses make clear that without a new international governance approach to HFCs, we may win the battle against CO_2 but lose the war against climate change.

At the 20th Meeting of the Parties to the Montreal Protocol last year, the Parties initiated efforts to address the growing threat from HFCs. Building on previous reports by TEAP and the Intergovernmental Panel on Climate Change ("IPCC"), the Parties adopted Decision XX/8.[3] Through Decision XX/8, the Parties commissioned further analysis of the climate threats and opportunities presented by HFCs and requested the Ozone Secretariat host an open-ended dialogue and workshop with UNFCCC and other stakeholders to explore opportunities to leverage the experience and expertise of the Montreal Protocol to reduce HFC emissions.[4]

This year, the Federated States of Micronesia and Mauritius, two island nations facing existential threats from climate change, submitted a joint proposal to amend the Montreal Protocol to control—regulate in Montreal-Protocol vernacular—HFCs and limit their proliferation.[5] If adopted by the Parties, this proposal will strengthen the Montreal Protocol to minimize the adverse environmental effects of actions taken under the Montreal Protocol, holistically control the sectors and replacements for chemicals traditionally it regulates and deliver further—and desperately needed—climate mitigation.

This document seeks to answer the frequently asked questions related to the proposed amendment to control HFCs under the Montreal Protocol (the "2009 HFC Amendment").

QUESTION 1: What are HFCs?

HFCs are powerful GHGs primarily produced for use as substitutes for ozone-depleting substances ("ODSs") in refrigeration, air-conditioning, insulating foams, solvents, aerosols, and fire protection.[6] One important exception is HFC-23, which is an unintentional byproduct of the HCFC-22 production process and not used as an ODS substitute.[7] Over the last decade, HFC emissions have increased dramatically as ODSs controlled under the Montreal Protocol—such as chlorofluorocarbons ("CFCs") and hydrochlorofluorocarbons ("HCFCs")—have been phased out.[8]

HFCs have several unique features that should inform their regulation. First, HFCs are synthetic. Unlike the three largest contributors to climate change—CO_2, methane ("CH_4"), and nitrous oxide ("N_2O")—HFCs do not exist in the natural environment. There exist no natural cycles to absorb HFC emissions; their longevity is constrained only by their atmospheric lifetimes. Therefore, eliminating atmospheric concentrations of HFCs is entirely within our control and requires HFC emission reductions from man-made sources.

Second, with one exception, HFCs are products themselves. Unlike CO_2, CH_4, and N_2O, which are unintended emissions from industrial and agricultural processes, HFCs are intentionally produced for specified purposes. As a result, the appropriate governance approaches to control HFC emissions likewise differ. In situations where the pollutant itself is the product, direct regulation of its production and consumption has proven to be a more-effective form of regulation. (**See Questions 3–4**.) It is possible to replace high-GWP HFCs with less-polluting substances by regulating HFC production and consumption under the Montreal Protocol—the same approach successfully applied to CFCs and HCFCs—while retaining the same societal benefits.[9]

Third, currently produced HFCs have high global warming potentials ("GWPs") and short atmospheric lifetimes. Sometimes dubbed "super GHGs," HFCs are hundreds to thousands of times more potent climate forcers than CO_2 on a 100-year GWP basis.[10] The three most pervasive HFCs—HFC-134a, HFC-125, and HFC-143a—have atmospheric lifetimes of 14, 29, and 52 years, respectively.[11] Due to their short atmospheric lifetimes, fast-action controls can have an immediate benefit on reducing climate forcing. The near- and mid-term opportunity for climate protection is much greater than presented under current methodologies for calculating CO_2 equivalence based on 100-year GWP, which underestimate the near- and mid-term climate-mitigation potential of reducing HFC emissions.[12]

QUESTION 2: What is the contribution from HFCs to climate change?

HFC emissions are projected to increase significantly in the coming decades. Their increase is primarily the result of two interrelated causes. First, there is sustained growth in demand for refrigerators air conditioners as developing countries increase their disposable income under improving economic conditions.[13] Second, the CFC phase-out and accelerated HCFC phase-out are forcing countries to transition away from ODSs to substitutes not controlled under the Montreal Protocol—often to high-GWP HFCs.[14] Recent projections of global HFC emissions reveal a precipitous upward trend, translating into significant climate forcing.

In the absence of regulation, aggregate HFC emissions are expected to comprise a sizeable percentage of the overall climate problem. In the near-term, HFC emissions are projected to increase after 2013 and will significantly exceed previous estimates after 2025.[15] In 2002, global HFC emissions were approximately 0.43 Gt CO_2-equivalent ("CO_2-eq.") per year.[16] Estimates from IPCC and TEAP in 2005 project that global HFC emissions under business-as-usual ("BAU") scenarios will reach 1.2 Gt CO_2-eq. per year in 2015—a roughly 300% increase.[17] In 2009, TEAP updated this emissions data for several sectors revealing that global HFC emissions in 2015 are likely to be approximately 1.4 Gt CO_2-eq.[18] Thereafter, HFC emissions quickly accelerate. By 2040, HFC emissions are expected to reach 4.2-6.9 Gt CO_2-eq. per year and 5.5–8.8 Gt CO_2-eq. per year by 2050, which is equivalent to 9-19% of projected global CO_2 emissions under BAU scenarios.[19] Under long-term CO_2 stabilization scenarios at atmospheric mixing ratios of 450 and 550 parts per million ("ppm"), the projected HFC contributions in 2050 are 28–45% and 14–23% of CO_2 emissions, respectively.[20] Notably, HFC emissions in developing countries will be up to 800% greater than in developed countries.[21] In the aggregate, total HFC emissions during the 2013-2050 timeframe under BAU scenarios will be 110–170 Gt CO_2-eq.[22]

QUESTION 3: What are the climate benefits of phasing-down HFC production and consumption?

Reducing HFC emissions through a production and consumption phase-down offers policymakers a win-win opportunity to achieve substantial climate protection now and avert significant climate impacts in the future while doing so in the most cost-effective manner. (**See Question 4**.) A review of several approaches to reducing future HFC emissions illustrates the climate-mitigation potential.

A 2009 assessment by TEAP reviewed the mitigation potential of employing a series of *ad hoc* national and regional mitigation measures and best practices to those sectors responsible for the largest amounts of HFC emissions. Under that approach, in 2015, HFC emissions can be reduced from BAU scenario by 0.2 Gt CO_2-eq. per year, a 30% reduction.[23] Emission reductions in future years are even greater.

This year, an article published in the Proceedings of the National Academy of Sciences by leading ozone and climate scientists reviewed a range of HFC emission reduction measures, including a comprehensive global HFC production and consumption phase-down. That analysis revealed that adopting an HFC production and consumption phase-down schedule whereby developed and developing countries freeze production and consumption at the preceding year's levels in 2014 and 2024, respectively, followed by an annual decrease in consumption of 4%, with a maximum reduction of 80%, yields significant climate mitigation. Freezing production and consumption at 2014 and 2024 followed by a 4% annual decrease yields cumulative emission reductions of 28-43 Gt CO_2-eq. over the 2013-2040 timeframe and 70-113 Gt CO_2-eq. over the 2013-2050 timeframe.[24] By 2050, these emissions reductions are equivalent to 6-13 years of radiative-forcing growth from CO_2.[25]

The 2009 HFC Amendment currently under consideration by the Parties proposes a start-and-strengthen, technically feasible phase-down schedule that is more aggressive than that analyzed in the Proceedings of the National Academy of Sciences, beginning with a production and consumption freeze for developed countries in 2012 at the average of 2004-2006 levels, followed by a decrease of 5% per year, reaching 90% in 2030.[26] The 2009 HFC Amendment would allow the Parties to negotiate the grace period for developing countries, comparable to the 10-year grace period for ODSs.[27] Further, the 2009 HFC Amendment would require the Parties destroy HFC-23, thereby achieving additional HFC emission reductions not accounted for in any of the mitigation scenarios discussed herein. If adopted, the 2009 HFC Amendment would deliver even greater climate mitigation than all previous mitigation-potential scenarios.

QUESTION 4: Are existing international regulations adequate to control HFC emissions?

No. To date, market-based strategies to control HFC emissions have failed to provide solutions. Under the status quo, HFC emissions have increased dramatically. (**See Question 2**.) An additional strategy is needed to complement the Kyoto Protocol and Copenhagen outcome. Although several drivers of HFC proliferation are controlled under the Montreal Protocol, HFCs themselves are not. These drivers include: (i) ODS phase-outs; (ii) authorization to produce HCFC-22 and, in tandem, its unintentional byproduct, HFC-23; and (iii) funding of projects in developing countries to replace ODSs with high-GWP HFCs through the Multilateral Fund for the Implementation of the Montreal Protocol ("MLF"). Yet despite the clear nexus to substances controlled under the Montreal Protocol, HFCs were nevertheless included among the six GHGs targeted for emission reductions under the Kyoto Protocol to UNFCCC ("Kyoto Protocol").[28] This leads the existing ozone and climate regimes to work, at times, at cross-purposes and is creating regulatory loopholes and perverse incentives that undermine international efforts to protect the climate system.

For purposes of climate governance, HFCs should be divided into two general categories: (i) HFCs that are produced as products themselves and constitute a growing majority of total HFC CO_2-eq. emissions; and (ii) HFC-23, produced as an unintentional byproduct of HCFC-22, which constitutes a minority, and proportionally decreasing, amount of total HFC CO_2-eq. emissions.[29] In 2015, under BAU scenarios, the proportion of HFC emissions from HFC products will rise to 75% of total HFC CO_2-eq. emissions. HFC-23 will make up the remaining 25%.[30] After 2015, HFC-23 emissions become relatively small compared with other HFCs.

While this distinction is important for reasons discussed later, certain features of HFC governance apply to both categories. (**See Questions 4A–4B**.) First, it is far more cost-effective to reduce HFC production and consumption upstream than to control emissions downstream. Second, HFC emission regulations under the Kyoto Protocol neither control nor provide adequate incentives to reduce HFC emissions in developing countries. Third, trading short-lived HFC emission reductions in exchange for long-lived CO_2 emissions under a cap-and-trade scheme provides short-term cooling but commits the planet to long-term warming. Each of these issues is addressed in turn.

The history of the Montreal Protocol clearly demonstrates that regulating HFC production and consumption will deliver cost-effective and sum-certain climate mitigation. Most ODSs—like

their HFC substitutes—are powerful climate forcing agents. From 1990-2010, the Montreal Protocol will have reduced ODS emissions by a net of 135 Gt CO_2-eq., delaying climate forcing by up to 12 years.[31] Over the Kyoto Protocol period from 1990–2010, the Montreal Protocol will have delivered approximately 8 Gt CO_2-eq. emissions reductions per year—roughly 6-7 times the annual emissions reductions expected from the Kyoto Protocol.[32] All of this has been accomplished at an incremental cost of US$2.4 billion provided to assist developing countries to achieve compliance with their obligations under the Montreal Protocol.[33]

Although phasing-down HFCs will be more expensive than past ODS phase-outs, it will still provide climate mitigation at a fraction of the cost of other mitigation measures and will be far more cost-effective than regulating HFCs at the point of emission. Even if, in a worse-case scenario, achieving the 70-113 Gt CO_2-eq. HFC emission reductions available by phasing down HFCs under the Montreal Protocol were to cost three times the total amount of incremental-cost funding made available to developing countries through MLF to date, the cost would still be comparable to the amount of money spent to achieve the 0.45 Gt CO_2-eq. HFC-23 emission reductions under CDM.[34]

Under the Kyoto Protocol, industrialized countries (Annex I Parties) are given assigned amounts of CO_2-eq. GHG emissions for the GHGs listed in Annex A—which includes HFCs—for the 2008-2012 commitment period. The agreed-upon emission limitations or reductions are listed in Annex B.[35] Developing countries, however, have no binding emissions limitation or reduction targets under the Kyoto Protocol. And looking beyond the 2008-2012 commitment period, developing countries appear unlikely to take on any binding emission reduction targets.[36] This is particularly problematic because future growth in HFC production, consumption, and emissions will occur primarily in developing countries. (**See Question 2**.)

That expected growth in HFC emissions occur primarily in developing countries underscores the need for a control strategy outside the current climate-negotiation paradigm whereby developed countries adopt "legally binding mitigation commitments or actions" while developing countries contribute by undertaking "nationally appropriate mitigation actions."[37] Under that paradigm, developed-country economies would be capped while developing-country economies would be "uncapped," an unsatisfactory approach given where most HFC growth is expected to occur. For these reasons, policymakers have turned to the Montreal Protocol, an international treaty that follows the principle of common but differentiated responsibilities through the equitable transfer of financing and technology and differentiated reduction commitments to reduce production and consumption through direct regulation in both developed and developing countries.

Because the Kyoto Protocol and the post-2012 climate regime resulting from the agreed outcome of negotiations under UNFCCC (hereinafter the "Agreed Outcome") will not require HFC emission reductions in developing countries, the only incentive for developing countries to reduce HFC emissions under the Kyoto Protocol is through the Clean Development Mechanism ("CDM") and its successor. Under the Kyoto Protocol, certain HFC emission reductions in developing countries can be used under Article 12 to generate Certified Emission Reductions ("CERs") through CDM, which can then be bought and sold on carbon markets.[38] These offsets allow an industrialized country (an Annex I Party) to emit an equal amount of CO_2-eq. of another GHG above their assigned amounts in Annex B.[39] But national restrictions on the use of CERs

from CDM to assist Annex I Parties to achieve compliance with obligations under Article 3 and Annex B means that CDM cannot generate enough CERs through HFC emission reductions to keep pace with the future growth in HFC emissions and mitigation potential in developing countries.[40] In sum, there will be no incentive to reduce most HFC emissions in developing countries under CDM.

And for HFC emission reductions CDM does achieve in developing countries, the costs of achieving those reductions is significantly greater than the actual cost of avoiding the emissions—sometimes more than 50 times greater.[41] (**See Question 4B**.) For these reasons, under the Kyoto Protocol, HFC emissions are increasing dramatically. (**See Question 2**.)

Permitting HFC emission reductions in developing countries to create offsets to allow emissions of longer-living GHGs in industrialized countries (or permitting industrialized countries to trade HFC emissions with CO_2 emissions on a 100-year GWP basis within their own national caps) actually commits the planet to more warming in the long-term. Under the current CDM, and future carbon market mechanisms under discussion within UNFCCC, HFC emission reductions are and may continue to generate CERs, which can then be traded on carbon markets to allow a CO_2-eq. amount of another GHG—usually CO_2—to be emitted based on its 100-year GWP.[42] But this methodology for calculating the value of HFC emission reductions has the practical effect of postponing needed emission reductions to future generations and committing the planet to long-term warming.

Most HFCs are short-lived, and the most prevalent HFCs have an atmospheric lifetime of 14, 29, or 52 years.[43] In contrast, CO_2 has an atmospheric lifetime of between 500 and 1,000 years.[44] This means that trading HFC emission reductions to allow CO_2 emission increases on a 100-year-GWP basis delivers a net short-term cooling through the atmospheric life of the HFC, until gradually becoming climate neutral at 100 years, followed by a commitment to long-term warming beyond 100 years until the end of the atmospheric life of the CO_2 emissions, i.e., up to 1,000 years. In other words, trading HFC emissions in developing countries to permit CO_2 emissions in industrialized countries (or trading between HFC and CO_2 emissions within industrialized countries' caps) is just a sophisticated means of trading away the climate of future generations to avoid making the meaningful cuts in CO_2 emissions today that are necessary to prevent dangerous anthropogenic interference with the climate system in the long-term.

QUESTION 4A: Are existing regulations adequate to control emissions of the vast majority of HFCs which are substitutes for ODSs?

No. Demand for high-GWP HFC products and their emissions will increase dramatically due to the phase-out of ODSs under the Montreal Protocol and the increase in disposable income in developing countries. The largest increase in HFC emissions will occur in developing countries. (**See Question 2**.) But, under the Kyoto Protocol, developing countries have no emission limitations and are unlikely to accept emission limitation or reduction commitments in the mid-term under UNFCCC. (**See Question 4**.)

The Kyoto Protocol also misdirects its focus on regulating HFCs at the point of emissions, failing to provide any control measures aimed at production and consumption, the points in the

HFC life-cycle where it is most cost-effective and efficient to monitor and reduce emissions. (**See Question 4**.) Further, the Kyoto Protocol does not provide funding for the implementation of a comprehensive program to reduce HFC emissions in developing countries. Incentives to reduce emissions in developing countries under the Kyoto Protocol—via CDM—are *ad hoc* and require significantly more funding than the actual costs of reducing HFC emissions. (**See Question 4**.) In addition, because CDM is an emissions trading mechanism, in the best case scenario, the transaction results in a no-net-decrease outcome, i.e., it is climate neutral, at a time when reductions are desperately needed. (**See Question 4**.)

The utility of the carbon market, which can be an effective tool to achieve GHG emission reductions, is likewise adversely affected. During the 2008-2012 commitment period, cheap HFC-related CERs, particularly reductions of HFC-23, have flooded the carbon market and threaten the integrity of CDM.[45] The availability of these CERs is preventing carbon financing from reaching other climate mitigation projects, such as energy efficiency and renewable energy, which promote long-term emission reductions and sustainable development—the stated purpose of CDM under Kyoto Protocol Article 12(2). It is also unduly delaying industrialized countries (Annex I Parties) from addressing other GHG emissions, such as CO_2, that require a sustained, long-term effort to reduce. (**See Question 4**.) Currently, industrialized countries are moving into high-GWP HFC alternatives to comply with domestic controls or in response to market pressure from the cap-and-trade scheme under the Kyoto Protocol.[46] At the same time, developing countries are beginning to transition into high-GWP HFCs to replace ODSs phased-out under the Montreal Protocol. These opposing trends will present a new opportunity to produce cheap HFC-related CERs by replacing high-GWP HFCs in developing countries with low- and no-GWP alternatives that are being developed in industrialized countries, thus allowing cheap HFC-related CERs to continue to undermine carbon markets.

Decision XIX/6, which accelerated the phase-out of HCFCs, states that the Parties will:

> agree that the … [MLF], when developing and applying funding criteria for projects and programmes, and taking into account paragraph 6, give priority to cost-effective projects and programmes which focus on, inter alia: … (b) [s]ubstitutes 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* …[47]

This means that MLF can apply funding to implement the HCFC phase-out in a manner that avoids high-GWP HFCs. The 2009 HFC Amendment, however, would require that MLF harmonize the HCFC phase-out with the HFC phase-down and, by eventually creating HFC phase-down obligations in Article 5 Parties, also trigger automatic MLF funding to assist developing countries' compliances under Montreal Protocol Article 10.

Finally, given the complexities of the climate negotiations and the numerous GHGs and sources to be regulated, UNFCCC has been unable to give sufficient attention to the increasing threat of HFC emissions. Indeed, most climate negotiators are only familiar with HFC-23, although it is small and shrinking percentage of all HFC CO_2-eq. emissions, and are unaware of the substantial threat and opportunity presented by the vast majority of other HFCs. (**See Questions 2–4**.) The

Montreal Protocol is the only international institution with the capacity to develop, negotiate, and agree to effective HFC regulation in time to prevent developing countries from committing to dangerous high-GWP HFC technologies. (**See Question 5**.)

QUESTION 4B: Are existing regulations adequate to control emissions of HFC-23?

No. HFC-23 is another important contributor to climate forcing, but its contribution to climate change is far less significant that its role in weakening the climate governance regime.[48] (**See Question 4**.) Unlike other HFCs, HFC-23 has a longer atmospheric lifetime of 270 years so the tradeoff between short-term cooling and long-term warming when traded with CO_2 is not as significant as it is for other HFCs.[49] But because of its incredibly high 100-year GWP of 14,800 and the cheap cost of preventing HFC-23 emissions through destruction, HFC-23 has significantly undermined the integrity of the carbon market. (**See Question 4**.)

HFC-23 is generated as an unintentional by-product of HCFC-22, which is an ODS refrigerant with several different applications. HFC-23 is formed at the reactor stage of manufacture of HCFC-22 and its formation depends on the conditions used in the manufacturing process.[50] As a result, the quantity of HFC-23 produced is directly related to the production of HCFC-22.[51] While direct HCFC-22 production and consumption is declining, the indirect use of HCFC-22 as a fluoropolymer feedstock is expected to double by 2015 and may continue to grow thereafter under BAU scenarios.[52] While the Montreal Protocol will eventually phase-out the direct use of HCFC-22, its use as a feedstock escapes regulation under the Montreal Protocol, potentially causing global emissions of HFC-23 to increase as well, though not as rapidly as other HFCs.[53] (**See Question 2**.)

CDM is inadequate to address HFC-23 emissions for several reasons. First, because HFC-23 emissions can be reduced at a fraction of the cost of other mitigation measures, the carbon market is already flooded with cheap HFC-23 CERs that serve to shield industrialized countries from making meaningful CO_2 reductions. (**See Question 4**.) The use of HFC CERs is also restricted to only a percentage of industrialized countries' Kyoto-Protocol commitments and therefore does not provide incentives to reduce the vast majority of HFC emissions.[54] Further, recognizing the serious threat to CDM posed by these cheap credits, the Executive Board of CDM has imposed limitations on the eligibility of future HFC-23-destruction projects that effectively place a moratorium on new HFC-23-destruction projects.[55] This means that those facilities that do not meet the new criteria for CDM approval—and are not operating under existing CDM approval—have no incentive to destroy the unwanted HFC-23 they continue to produce as an unintentional HCFC-22 byproduct. As a result, these facilities continue to emit HFC-23 despite the inexpensive means of destroying it.[56]

Finally, the reductions that are achieved are done so at a higher cost than under the Montreal-Protocol.[57] This is because CDM allowed CERs to be generated from HFC-23 destruction. Although HFC-23 can be destroyed at a cost of only US$0.20 per CO_2-eq. tonne,[58] it will be sold on the carbon markets at average price of US$22.[59] Conservatively assuming that each CER was only sold for US$15 during the first commitment period of the Kyoto Protocol, approximately 0.45 Gt CO_2-eq. will be destroyed during the first commitment period at a cost of approximately US$6.9 billion.[60] Those same emissions reductions could have been achieved using incremental-

cost funding under the Montreal Protocol for approximately US$91 million.[61] Relying upon CDM to reduce HFC-23 emissions is an inefficient, incomplete, and unnecessarily expensive means of reducing HFC-23 emissions in developing countries. Rather than promote climate protection, HFC-23 destruction attracted funding through carbon markets that could, and should, have been used to reduce emissions of other GHGs and promote sustainable development.

If HFCs were instead controlled under the Montreal Protocol, HFC emissions reductions would be achieved by requiring Parties destroy HFC-23 and establishing a HFC production and consumption phase-down schedule for all other HFCs, as was proposed in the 2009 HFC Amendment.[62] The full incremental costs of compliance with these obligations for developing countries would be required, by operation of Article 10 of the Montreal Protocol, to be made available to developing countries through MLF.[63] In order to reach a global HFC agreement, a compromise may need to be reached whereby existing HFC-23 destruction CDM projects are "grandfathered" into the new HFC governance regime until the expiration of their current CDM crediting period, but not renewed.

QUESTION 5: Why should we use the Montreal Protocol to phase down HFC production and consumption?

For the simple reason that it provides the fastest, most cost-effective means of reducing HFC emissions. The Montreal Protocol benefits from unique structural advantages, decades-long expertise, and cost-effective implementation tools. In addition, the proliferation of HFC emissions is a direct result of Montreal Protocol's regulation of ODSs, creating potentially conflicting environmental mandates that can only be addressed by bringing these substances under the same regulatory authority. (**See Question 4**.)

The Montreal Protocol enjoys several advantages that will allow it to quickly adopt and implement effective controls for HFCs. The treaty has near-universal ratification; there are currently 194 Parties to the treaty.[64] It provides differentiated reduction commitments for both developed and developing countries based on the principle of common but differentiated responsibilities. Yet all the Parties to the Montreal Protocol have reduction commitments under the treaty, including developing countries which accept the same reduction commitments as their developed-country counterparts but with a grace period negotiated by the Parties.[65] There exists a fully-functioning and effective financial transfer mechanism—MLF—that must assist developing countries to phase-down high-GWP HFCs by providing financing for the incremental costs of compliance with its control measures.[66] It has an effective technology-transfer mechanism, enforceable compliance mechanisms, and is supported by real-time scientific and technical assessments and a rapid regulatory response through "adjustments." Together, these tools have resulted in an unparalleled level of environmental success and compliance with the commitments and obligations established under the Montreal Protocol.

Another key advantage to utilizing the Montreal Protocol is the speed at which the Montreal Protocol can develop, negotiate, and adopt of phase-down schedule for HFCs. Regulating HFCs under the Montreal Protocol would require an amendment to the Montreal Protocol, which could happen as early as 2009.[67] And though ratification by a sufficient number of Parties such that the amendment enters into force could extend into 2010 or beyond,[68] this process is still likely

quicker than developing, negotiating, and ratifying a new, separate protocol to UNFCCC.[69] Further, historically, amendments to the Montreal Protocol enter into force *de facto* pending ratification because the Parties tend to view ratification as inevitable and, therefore, conform their behavior accordingly so as to avoid actions that would be expensive to undo. Once the amendment secures a sufficient number of ratifications to enter into force *de jure* for ratifying Parties, the trade restrictions with non-ratifying Parties under Article 4 of the Montreal Protocol provide a powerful incentive for all Parties to ratify the treaty forthwith.[70]

In addition, the Montreal Protocol has been able to secure reduction commitments from all Parties because it has an effective financial- and technology-transfer mechanism—MLF—that is trusted by both developed and developing countries and does not need to be renegotiated. MLF has ensured that not only do developing countries also commit to reductions alongside the more aggressive commitments of their developed-country counterparts, but that developing countries have the resources necessary to implement measures to meet their commitments under the treaty. Since its inception almost two decades ago, MLF has acquired an in-depth understanding of the limited number of sectors it regulates. It would be unwise to squander this expertise.

The Montreal Protocol has also cultivated a cadre of ozone officers at 146 national ozone offices organized into nine ozone networks throughout the developing world—seasoned bureaucrats prepared to implement the phase-down schedules agreed to under the treaty and efficiently and cost-effectively utilize the funding made available through MLF. And these "boots on the ground" have the requisite expertise and wherewithal to implement an HFC phase-down tailored to match the scale and timing of the problem.

Further, the Montreal Protocol has several successful scientific and technical bodies in existence—the Scientific Assessment Panel ("SAP"), TEAP, and Technical Options Committees ("TOCs")—that have decades of experience working closely with industry. These bodies produce real-time reports using their familiarity with the technology, both commercially available and in-development, in the handful of sectors that use ODSs. These are the same sectors that use HFCs, and the expertise is fully transferable.

QUESTION 6: Can the Montreal Protocol, an ozone treaty, be used to control a GHG that is not an ODS?

Yes. The Montreal Protocol can lawfully control HFCs to harmonize the regulation of the chemicals and sectors it controls to ensure that activities aimed at protecting the ozone layer under the Montreal Protocol do not result in other "adverse effects" to the environment.[71] Activities taken pursuant to the Montreal Protocol are driving rising production, consumption, and emissions of HFCs. (**See Question 4**.) The undeniable causal connection between these activities and the proliferation of HFCs creates a sufficient nexus to allow the Montreal Protocol to control HFCs.

Lawfully amending the Montreal Protocol to control HFCs is consistent with the obligations of the Parties under the Vienna Convention for the Protection of the Ozone Layer ("Ozone Convention") and Montreal Protocol. The General Obligations contained in Article 2 of the Ozone Convention are sufficiently broad in scope to allow, and indeed practically compel, the

Parties to control ODS substitutes such as HFCs. Article 2(2)(b) sets forth the following obligation:

> 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*…[72]

One of the principal justifications for regulating HFCs under the Montreal Protocol is to *harmonize* the regulation of the chemicals used in the sectors controlled by the Montreal Protocol. It is *activities* under the Montreal Protocol that have driven the increase in production, consumption, and emissions of HFCs. (**See Question 4**.)

While HFCs are not ODSs, they are powerful GHGs and are a contributing cause of climate change, which explicitly qualifies as an "adverse effect" 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.[73]

Activities to aid the recovery of the ozone layer through regulation of production and consumption of CFCs, HCFCs, and other ODSs, constitute a *modification of the ozone layer*. These *activities*, and others, 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).

This interpretation of Article 2 of the Ozone Convention is also supported by subsequent agreements among the Parties relating to the Ozone Convention, a means of interpreting treaties enshrined in Article 31 of the Vienna Convention on the Law of Treaties.[74] The text of the Montreal Protocol makes clear that the ODS phase-outs would not occur in a vacuum but would consider relevant scientific information and environmental impacts, including the climatic effects which are specifically noted in the Preamble.[75] An example of an amendment to the Montreal Protocol implementing this holistic environmental approach to ODS regulation is found in Article 2F(7)(c).[76] Further, the history of the decisions and reports adopted by the Parties to the Montreal Protocol, who are also Parties to the Ozone Convention, demonstrates their longstanding view that ensuring the substitutes used to replace ODSs, including HFCs, are as environmentally protective as possible is an obligation of the Parties to the Montreal Protocol and Ozone Convention.[77]

In 2007, the Parties decided to accelerate the phase-out of HCFCs and explicitly acknowledged that they were primarily motivated by the contribution HCFCs emissions would otherwise make to climate change. At the time, the Parties committed to preserving the climate benefits of

reducing HCFCs by addressing the threat to the climate system posed by HCFC substitutes.[78] In the Meeting of the Parties to the Montreal Protocol last year, the Parties affirmed their obligation and commitment to ensure that activities taken pursuant to the Montreal Protocol do not aggravate the climate crisis and agreed to Decision XX/8.[79]

The history of the Montreal Protocol supports the plain meaning interpretation of the Ozone Convention and Montreal Protocol set forth herein. The regulation of HFCs under the Montreal Protocol is consistent with the General Obligations of the Ozone Convention as they have been interpreted by the Parties.[80]

QUESTION 7: How will the Montreal Protocol complement UNFCCC, the Kyoto Protocol, and the Agreed Outcome?

Regulating the production and consumption of HFCs is complementary to and consistent with GHG emissions regulation under UNFCCC and Kyoto Protocol. While regulating HFCs under the Montreal Protocol will have a limited, but manageable, effect on the reporting requirements under UNFCCC and Kyoto Protocol, it will not upset the operation of either treaty. The threshold question is one of jurisdiction. The Kyoto Protocol focuses on regulating chemicals at the point of emission, and there is a regulatory void whereby no international agreement regulates HFC production and consumption. Regulating HFC production and consumption under the Montreal Protocol seeks to fill this void and complement emissions-based regulation under the Kyoto Protocol.

A regulatory HFC phase-down under the Montreal Protocol is entirely consistent with principles set forth in UNFCCC Article 3 and will help achieve UNFCCC's ultimate objective of ensuring "stabilization of [GHG] concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system."[81] In fact, it will prudently utilize and existing international institution to quickly and more efficiently solve this piece of the climate puzzle. This type of cooperation is practically compelled under UNFCCC Article 7(2)(l):

> To this end, [the Conference of the Parties] shall: … Seek and *utilize, where appropriate, the services and cooperation of, and information provided by, competent international organizations and intergovernmental* and non-governmental *bodies* …[82]

Precedent for implementing the cooperation and coordination envisioned in UNFCCC Article 7(2)(l) has been established under Kyoto Protocol Article 2(2) which delegates responsibility for pursuing limitations or reductions of GHGs from aviation and bunker fuels to the International Civil Aviation Organization ("ICAO") and International Maritime Organization ("IMO") respectively.[83] A similar enabling provision explicitly recognizing that the Parties shall work through the Montreal Protocol to reduce HFC production, consumption, and/or emissions can be included in an amendment to the Kyoto Protocol or the Agreed Outcome as part of an international emission-reduction arrangement for HFC emissions.

Impact on reporting requirements: Regulating HFCs under the Montreal Protocol will have a limited, but manageable, effect on the reporting requirements under UNFCCC and the Kyoto

Protocol. The operation of either treaty, however, will not be impacted in a meaningful way. Both treaties specifically exclude GHGs controlled by the Montreal Protocol from reporting requirements. It should also be remembered that although an amendment to the Montreal Protocol may be adopted this year, HFC production and consumption will not be controlled by the Montreal Protocol until 2012 at the earliest.[84] In advance of that date, the Parties to UNFCCC and the Kyoto Protocol will have sufficient time to respond to HFC regulation under the Montreal Protocol through a decision interpreting the affected provisions of their treaties, a formal amendment, or as part of the Agreed Outcome in order to incorporate any changes they deem necessary to harmonize the regulation and reporting of HFCs in a way that continues to support the objectives of the Kyoto Protocol and UNFCCC.[85]

For example, the Parties to UNFCCC and the Kyoto Protocol can ensure their respective treaties continue to receive the same information they currently receive under UNFCCC Article 4 and Kyoto Protocol Articles 5 and 7. Strict reporting requirements for substances controlled by the Montreal Protocol are already in place and required of Parties to the Montreal Protocol.[86] These requirements are also applicable to HFCs under the 2009 HFC Amendment.[87] Additional requirements may be added to the 2009 HFC Amendment to conform to the requirements for other GHGs regulated under UNFCCC and the Kyoto Protocol. Once sufficient reporting requirements are established under the Montreal Protocol, all that is needed to ensure they are communicated to UNFCCC, the Kyoto Protocol, or the Agreed Outcome is a provision in the Montreal Protocol that requires the Ozone Secretariat communicate this information to the appropriate entities forthwith. Already, provisions requiring cooperation and coordination with UNFCCC, the Kyoto Protocol, and the Agreed Outcome are included in the 2009 HFC Amendment, and more can be added.[88]

Other Impacts: Other limited impacts on the operation of UNFCCC and the Kyoto Protocol can also be managed through appropriate responses within those treaties.

Certain "soft" commitments under UNFCCC Article 4 are already required of GHGs controlled by the Montreal Protocol, but other commitments will no longer be applicable to HFCs.[89] These "soft" commitments are not central to UNFCCC operation and, although not required, an authoritative interpretation or textual changes can be made to these provisions to ensure they continue to support the objectives of the treaty in advance of the Montreal Protocol controlling HFC production and consumption, if desired.[90]

It must also be noted that the first commitment period under the Kyoto Protocol extends from 2008–2012.[91] An HFC phase-down whereby the Montreal Protocol begins controlling HFC production and consumption beginning in 2013 would have no discernible impact on the operation of the Kyoto Protocol during the first commitment period. An HFC phase-down beginning before 2013—such as the schedule proposed in the 2009 HFC Amendment—if adopted by the Parties to the Montreal Protocol and entering into force before 2012—would not modify Kyoto-Protocol emission-limitation commitments. Any concerns that countries will not receive credit for reductions otherwise achieved are moot because, under Article 3 and Annexes I and A of the Kyoto Protocol, parties are permitted to take advantage of any HFC emission reductions—without limitation—regardless of the international body that mandates them.[92]

Therefore, compliance with any Montreal-Protocol-mandated HFC reductions would be properly accredited to any party making them during first commitment period from 2008-2012.

Alternatively, policymakers can grant plenary jurisdiction over HFCs to the Montreal Protocol, removing HFCs entirely from the basket of GHGs under UNFCCC, the Kyoto Protocol, and the Agreed Outcome. Bringing all sources of HFC emissions squarely under Montreal-Protocol "control" will cleanly sever—disaggregate—HFCs from UNFCCC and the Kyoto Protocol's basket of GHGs. HFC emission reduction in excess of those required under the Montreal Protocol can be tied back to the Kyoto Protocol or Agreed Outcome under a mechanism similar to CDM whereby these "additional" emissions reductions generate offsets equal to, or at a ratio proportional to, the amount of excess CO_2-eq. HFC emission reductions achieved.

A decision to grant limited or plenary jurisdiction over HFCs to the Montreal Protocol should be considered one of the key indicators of success in Copenhagen. And, importantly, a Montreal-Protocol amendment regulating HFCs is already well underway with a formal decision by the Parties to the Montreal Protocol to seek coordination,[93] a proposed amendment to the Montreal Protocol seeking jurisdiction and cooperation,[94] interest expressed by the United States in the 2009 HFC Amendment,[95] and a submission to UNFCCC on behalf of the European Community proposing that the Copenhagen agreement specifically include an "international emission reduction arrangement for HFC emissions."[96] In other words, climate and ozone negotiators have already begun to coordinate and cooperate on an HFC phase-down in a manner that complements the Agreed Outcome.

Finally, if the Parties adopt an HFC production and consumption phase-down schedule under the Montreal Protocol but leave HFCs within the basket of GHGs under the Kyoto Protocol or the Agreed Outcome, there is a question as to whether HFC emission reductions achieved in developing countries by avoiding the transition to high-GWP HFCs can still generate CERs under CDM and its successor in advance of their freeze date and phase-down. In the past, developing countries agree to a phase-down schedule under the Montreal Protocol beginning after developed countries and following a grace period of several years. This means, that in the next commitment period under the Kyoto Protocol or Agreed Outcome, developing countries will have no binding HFC commitments under the Montreal Protocol and, under the current CDM, would be eligible to generate CERs by avoiding the use of high-GWP HFCs. (**See Question 4A**.)

The 2009 HFC Amendment does not contain provisions specifically addressing this possibility.[97] The 2009 HFC Amendment does, however, propose changes to Montreal Protocol Article 10 that builds on Decision XIX/6 whereby funding provided to developing countries through MLF to assist developing countries achieve compliance with their commitments under the HCFC accelerated phase-out *shall* give preference to replacements and alternatives other than high-GWP HFCs.[98] This means that funding already committed through MLF, as well as additional funding needed to fulfill this new mandate, can be used to avoid high-GWP HFCs thereby reducing the ultimate cost of the HFC phase-down and, at the same time, minimizing the number of opportunities to generate CERs by avoiding high-GWP HFCs in the future.

In addition, MLF Executive Committee is exploring whether it should establish a facility that draws on alternative funding sources to fund Montreal-Protocol-related activities that achieve climate benefits beyond the Parties' commitments under the treaty.[99] This facility, if established, could facilitate efforts to avoid high-GWP HFCs in developing countries to minimize the number of HFC-related CERs. If HFCs are phased-down under the Montreal Protocol but remain in the basket of GHGs under the Kyoto Protocol or Agreed Outcome, the Parties will need to clarify the their relationship of these chemicals to CDM and its successor in subsequent commitment periods as well as strengthen the proposed changes to Article 10 in the 2009 HFC Amendment.

QUESTION 8: Can the Montreal Protocol act at the Meeting of the Parties in November to control HFC production and consumption before the Conference of the Parties to UNFCCC in December?

Yes. Sufficient political support exists to build momentum toward the 21st Meeting of the Parties to the Montreal Protocol to seize this win-win opportunity to protect the climate system. For 20 years, the Montreal Protocol has forged a special relationship of trust, built upon success, with both developed and developing countries that will provide the authenticity needed to secure the necessary political will for this proposal.

The overlap between Parties to the Montreal Protocol, UNFCCC and the Kyoto Protocol will allow for coordination to quickly come to an agreement to control the production and consumption of HFCs in a way that supports the ultimate objective of all treaties. The Parties to these treaties can require the necessary coordination, beginning at the open-ended dialogue and workshop in Geneva, Switzerland this July, by reaching a decision at a sufficiently high level to give specific instructions to their ozone and climate negotiators, and their respective secretariats, to reach such an agreement. International treaties are ultimately beholden to the Parties. If the Parties wish to prevent the proliferation of HFCs by phasing-down their production and consumption under the Montreal Protocol, nothing in either treaty represents an insurmountable obstacle.

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[*] IGSD (www.igsd.org) welcomes any questions, comments, or insights readers may have regarding this document. Please send all correspondence to Pete M. Grabiel (pgrabiel@igsd.org) or Tim R. Grabiel (tgrabiel@igsd.org).

[1] Climate scientists now warn that anthropogenic GHG emissions are pushing the Earth toward climatic "tipping points" that will trigger abrupt climate changes and exacerbate the climate crisis. Potentially catastrophic impacts and runaway feedbacks include the disappearance of Arctic summer sea ice, disintegration of the Greenland Ice Sheet, collapse of the West Antarctic Ice Sheet, deglaciation of the Himalayan-Tibetan plateau, shutdown of the Atlantic Thermohaline Circulation, dieback of Amazonian and boreal forests, and the release of methane stored in permafrost and ocean hydrates. *See* Timothy Lenton et al., *Tipping elements in the Earth's climate system*, 105 PROC. OF THE NAT'L ACAD. OF SCI. 1786-1793 (2008); *see also* V. Ramanathan & Y. Feng, *On avoiding dangerous anthropogenic interference with the climate system: Formidable challenges ahead*, 105 PROC. OF THE NAT'L ACAD. OF SCI. 14245-14250 (2008).

[2] *See* TEAP, TASK FORCE DECISION XX/8 REPORT, ASSESSMENT OF ALTERNATIVES TO HCFCS AND HFCS AND UPDATE OF THE 2005 TEAP SUPPLEMENTAL REPORT DATA (May 2009) [hereinafter TEAP DECISION XX/8 REPORT]; Velders et al., *The large contribution of projected HFC emissions to future climate forcing*, PROC. NAT'L. ACAD. SCI. *Early Edition* (22 June 2009) [hereinafter Velders et al. 2009], http://www.pnas.org/content/early/2009/06/19/0902817106.

[3] *See* Montreal Protocol, Report of the Eighth Meeting of the Conference of the Parties to the Vienna Convention for the Protection of the Ozone Layer and Twentieth Meeting of the Parties to the Montreal Protocol on Substances that

Deplete the Ozone Layer, Doha, Qatar [hereinafter Report of the 20th MOP], at Decision XX/8. In May 1999, the IPCC and TEAP held a joint expert meeting on options to limit emissions of HFCs and PFCs and the TEAP issued a report on that subject later that year. *See* TEAP, THE IMPLICATIONS TO THE MONTREAL PROTOCOL OF THE INCLUSION OF HFCS AND PFCS IN THE KYOTO PROTOCOL (1999). In 2005, the IPCC and TEAP issued a joint report on the linkages between ozone layer and climate protection focusing specifically on HFCs and PFCs. *See* IPCC & 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]. This report was followed up by two reports from the TEAP in 2005 and 2007. *See* TEAP, SUPPLEMENT TO THE IPCC/TEAP REPORT (2005); 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].

[4] *See supra* note 3, Report of the 20th MOP at Decision XX/8.

[5] *See* Proposed Amendment to the Montreal Protocol (submitted by the Federated States of Micronesia and Mauritius) [hereinafter 2009 HFC Amendment], http://ozone.unep.org/Meeting_Documents/oewg/29oewg/OEWG-29-8E.pdf.

[6] *See supra* note 3, IPCC/TEAP 2005 SPECIAL REPORT at *Summary for Policymakers* at 4.

[7] *See supra* note 3, IPCC/TEAP 2005 SPECIAL REPORT at *Technical Summary* at 77; *see generally* ENVIRONMENTAL INVESTIGATION AGENCY, TURNING UP THE HEAT: LINKAGES BETWEEN OZONE LAYER DEPLETION AND CLIMATE CHANGE: THE URGENT CASE OF HCFCS AND HFCS (2006) [hereinafter EIA HFC-HCFC Report], http://www.eia-global.org/PDF/Report--TurningUpHeat--Climate--Aug06.pdf.

[8] *See supra* note 3, IPCC/TEAP 2005 SPECIAL REPORT at *Summary for Policymakers* at 4 and 8; *see also supra* note 2, TEAP Decision XX/8 Report at 127-129; 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] at Arts. 2A and 2F.

[9] *See supra* note 2, TEAP Decision XX/8 Report (discussing commercially-available and in-development alternatives to high-GWP HFCs).

[10] *See supra* note 3, IPCC/TEAP 2005 SPECIAL REPORT at *Summary for Policymakers* at 8.

[11] *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).

[12] *See id.*

[13] *See supra* note 3, IPCC/TEAP 2005 SPECIAL REPORT at 415; *see also supra* note 2, Velders et al. 2009 at 2-3.

[14] CFCs are already phased-out in developed countries and will be phased-out in developing countries in 2010. *See supra* note 8, Montreal Protocol at Art. 2A; *see also* 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). The HCFC accelerated phase-out establishes a freeze on HCFC production and consumption for Article 5 Parties, i.e. developing countries, at the average of 2009-2010 levels by 2013, with a 10% reduction by 2015, a 35% reduction by 2020, and a 67.5% reduction by 2025. Under the new phase-out schedule, Article 2 Parties, i.e. industrialized countries, must also reduce their production and consumption of HCFCs by 75% by 2010 and 90% by 2015 from 1989 levels. *See id.*

[15] *See supra* note 2, Velders et al. 2009 at 1.

[16] *See supra* note 3, IPCC/TEAP 2005 SPECIAL REPORT at 413.

[17] *Id.*

[18] *See supra* note 2, TEAP DECISION XX/8 REPORT at 10.

[19] *See supra* note 2, Velders et al. 2009 at 4; *see also* Velders et al., *The large contribution of projected HFC emissions to future climate forcing*, *Supporting information*, Proc. Nat'l Acad. Sci. *Early Edition*, (22 June 2009) [hereinafter Velders et al. 2009 Supporting Information], www.pnas.org/cgi/content/short/0902817106.

[20] *Id.*

[21] *Id.* at 1.

[22] *Id.*

[23] *See supra* note 2, TEAP DECISION XX/8 REPORT at 10; *see also supra* note 3, IPCC/TEAP 2005 SPECIAL REPORT at 413.

[24] *Id.*.
[25] *Id.* at 5.
[26] *See supra* note 5, 2009 HFC Amendment.
[27] The Montreal Protocol has never adopted a grace period for developing countries of longer than 10 years. *See supra* note 8, Montreal Protocol at Arts. 2-2I, and 5.
[28] *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.
[29] *See supra* note 3, IPCC/TEAP 2005 SPECIAL REPORT at 413. The accelerated phase-out of HCFCs agreed to in 2007 will dramatically reduce the amount of HCFC-22 produced for use in products in the coming years and decades. HCFC-22 produced for use in products is responsible for 60% of all HFC-23 byproduct emissions. *See id.* at 396; *see also supra* note 14.
[30] *See Id.*; *see also supra* note 2, TEAP DECISION XX/8 REPORT at 10.
[31] *See* Velders, et al., *The importance of the Montreal Protocol in protecting climate*, 104 PROC. NAT'L. ACAD. SCI. 4814-19, (20 March 2007).
[32] *See id.* at 4818.
[33] *See supra* note 3, Report of the 20th MOP at Annex VI, Doha Declaration.
[34] *Compare id.* (stating that US$ 2.4 billion has been spent to phase-out ODSs in developing countries thus far) *and infra* notes 59 - 62 and accompanying text (showing that all HFC-23 emission reductions achieved under CDM through 2012 would only costs US$ 91 million on an incremental costs funding basis under the Montreal Protocol) *with infra* notes 60 -61 (showing that US$ 6.9 billion will have been spent to reduce HFC-23 emissions from 2008-2012 under CDM).
[35] *See supra* note 28, Kyoto Protocol at Art. 3, Annex A, and Annex B.
[36] *See* AD HOC WORKING GROUP ON LONG-TERM COOPERATIVE ACTION UNDER THE CONVENTION, FCCC/AWGLCA/2009/8, NEGOTIATING TEXT (19 May 2009) [hereinafter AWG-LCA NEGOTIATING TEXT]; *see also* UNFCCC, AD HOC WORKING GROUP ON FURTHER COMMITMENTS FOR ANNEX I PARTIES UNDER THE KYOTO PROTOCOL, FCCC/KP/AWG/2009/8, NEGOTIATING TEXT (14 May 2009) [hereinafter AWG-KP NEGOTIATING TEXT].
[37] *See e.g. supra* note 36, AWG-LCA NEGOTIATING TEXT at ¶¶ 5 and 70-105.
[38] *See supra* note 28, Kyoto Protocol at Arts. 3 and 12.
[39] *Id.*
[40] For example, the European Union's Emissions Trading System ("EU ETS"), the largest emissions trading scheme in the world, allows Member States to limit the type and amount of CERs available for use. *See* EUROPEAN UNION, DIRECTIVE 2004/101/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL OF 27 OCTOBER 2004 AMENDING DIRECTIVE 2003/87/EC ESTABLISHING A SCHEME FOR GREENHOUSE GAS EMISSION ALLOWANCE TRADING WITHIN THE COMMUNITY, IN RESPECT OF THE KYOTO PROTOCOL'S PROJECT MECHANISMS (2004), Official Journal L 338, http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32004L0101:EN:HTML. The largest emitters in the EU ETS, Germany, France, the United Kingdom, and Italy, have adopted limits of 20, 13.5, 15, and 8%, respectively. *See* Europa, *Emissions Trading: Commission approves Romania's national allocation plans for 2007 and 2008-2012*, (26 October 2007), http://europa.eu/rapid/pressReleasesAction.do?reference=IP/07/1612. Canada's official GHG regulations will limit the purchase of CDM CERs for compliance purposes to 10% of each firm's target with the government to determine which types of credits will be eligible for compliance. *See* GOVERNMENT OF CANADA, REGULATORY FRAMEWORK FOR AIR EMISSIONS 15 (2008), http://www.ecoaction.gc.ca/news-nouvelles/pdf/20070426-1-eng.pdf.
[41] *See infra* notes 59 - 62 and accompanying text.
[42] *See supra* note 28, Kyoto Protocol at Arts. 3 and 12 and Annex A; *see also supra* note 36, AWG-LCA NEGOTIATING TEXT; *supra* note 36, AWG-KP NEGOTIATING TEXT.
[43] *See supra* note 11.
[44] *See* UNFCCC, *Global Climate Projections*, *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 824 (M. Allen et al. eds., 2007) (stating the atmospheric lifetime of CO_2 cannot be defined); *see also supra* note 11, AR4 THE PHYSICAL SCIENCE BASIS at 213; Solomon, et al., *Irreversible climate change due to carbon-dioxide*, 106 PROC. NAT'L ACAD. SCI. 1704-09 (10 Feb. 2009).
[45] CDM projects reducing HFC emissions are expected to account for up to 28% of all CERs in the 2008-2012 commitment period, although HFCs only account for 1-2% of the global radiative forcing of all well-mixed GHGs.

In 2006, HFC destruction projects amounted to the largest GHG emission reductions under CDM on a CO_2-eq. basis. *See* Pew Center on Global Climate Change, *Clean Development Mechanism Backgrounder—October 2008 Status Report*, at 4 (Oct. 2008), http://www.pewclimate.org/docUploads/CDM-Backgrounder.pdf; *see also supra* note 3, IPCC/TEAP 2005 SPECIAL REPORT at *Summary for Policymakers* at 6; *supra* note 7, EIA HFC-HCFC Report.

[46] *See supra* note 2, Velders et al. 2009 at 5 (discussing current and proposed domestic regulations of HFCs).

[47] *See supra* note 14, Report of the 19th MOP at Decision XIX/6 at ¶11.

[48] *See supra* notes 7 and 46.

[49] *See supra* note 11, AR4 THE PHYSICAL SCIENCE BASIS at 212.

[50] *See supra* note 3, IPCC/TEAP 2005 SPECIAL REPORT at 394.

[51] *Id.*

[52] *Id.* at 382 and 395.

[53] *See supra* notes 29-30.

[54] *See supra* note 40.

[55] *See* Executive Board of CDM, *Revision to the approved baseline and monitoring methodology AM0001*, Incineration of HFC 23 waste streams (Dec. 2006), http://cdm.unfccc.int/UserManagement/FileStorage/0TRNGTH2M00EKXXJ924MUXOOUJ115V; *see also* Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol, Decision 8/CMP.1, *Implications of the establishment of new hydrochlorofluorocarbon-22 (HCFC-22) facilities seeking to obtain certified emission reductions for the destruction of hydrofluorocarbon-23 (HFC-23)*, (9–10 Dec. 2005), http://unfccc.int/resource/docs/2005/cmp1/eng/08a01.pdf#page=100.

[56] For example, during the 2008-2012 commitment period, 1.4 Gt CO_2-eq. HFC-23 emissions will occur. But CDM will only provide incentives to destroy 0.45 Gt CO_2-eq. *Compare supra note* 3, IPCC/TEAP 2005 SPECIAL REPORT at 395 *with infra* note 61.

[57] *See supra* notes 31-34.

[58] *See supra* note 3, IPCC/TEAP 2005 SPECIAL REPORT at 397 and 399.

[59] *See* Carbon Finance, *Cost-effectiveness of CDM Projects*, Nov. 18, 2008, http://www.carbon-financeonline.com/index.cfm?section=cdmjianalysis&action=view&id=11663, (stating that the average price per CER from 2005-2008 was €16 or US$22 based on the exchange rate as of June 22, 2009).

[60] *See* UNFCCC, CDM Project Activities, Project Search (last accessed June 22, 2009), http://cdm.unfccc.int/Projects/projsearch.html (showing registered HFC destruction projects and the amount of CER estimated to be issued during the first commitment period).

[61] *See supra* notes 59 and 61.

[62] *See supra* note 5, 2009 HFC Amendment.

[63] *See supra* note 8, Montreal Protocol at Art. 10.

[64] Universal ratification of the Montreal Protocol is only pending ratification by East Timor.

[65] *See e.g. supra* note 8, Montreal Protocol at Arts. 2, 2A, 2F, and 5.

[66] *See supra* note 8, Montreal Protocol at Art. 10.

[67] *See supra* note 5, 2009 HFC Amendment.

[68] *See* Vienna Convention for the Protection of the Ozone Layer, *opened for signature* Mar. 22, 1985, 1513 U.N.T.S. 293 [hereinafter "Ozone Convention"] at Art. 3 ¶5 ("Amendments adopted in accordance with paragraph[] 3 … shall enter into force between parties having accepted them on the ninetieth day after the receipt by the Depositary of notification of their ratification, approval or acceptance by at least three-fourths of the Parties to this Convention or by at least two-thirds of the parties to the protocol concerned.").

[69] Based on the negotiating history of multilateral environmental agreements, developing, reaching agreement, and securing ratification of a new protocol addressing HFCs under UNFCCC would likely take several years.

[70] *See supra* note 8, Montreal Protocol at Art. 4.

[71] *Supra* note 69, Ozone Convention at Art. 2(2)(b).

[72] *Id.* (emphasis added).

[73] *Id.* at Art. 1(2) (emphasis added).

[74] *See* Vienna Convention on the Law of Treaties, *opened for signatures* May 23, 1969, 1155 U.N.T.S. 331 [hereinafter Vienna Convention on the Law of Treaties] at Art. 31(2).

[75] *See e.g. supra* note 8, Montreal Protocol at Preamble.

[76] *Supra* note 8, Montreal Protocol at Art. 2F(7)(c) ("[E]ach Party shall endeavor to ensure that … [HCFCs] are selected for use in a manner that minimizes ozone depletion in addition to meeting other environmental, safety and economic considerations.").

[77] *See e.g.* Montreal Protocol, Report of the Fifth Meeting of the Parties to the Montreal Protocol, Bangkok, Thailand (1993); Montreal Protocol, Report of the Sixth Meeting of the Parties to the Montreal Protocol, Nairobi, Kenya (1994) at Decision VI/13 (requesting the TEAP "consider how available alternatives compare with [HCFCs] with respect to such factors as energy efficiency [and] total global warming impact …"); Montreal Protocol, Report of the Tenth Meeting of the Parties to the Montreal Protocol, Cairo, Egypt (1998) at Declaration on HCFCs, HFCs, and PFCs (declaration issued by 41 Parties stating, there are "scientific indications that global warming could delay the recovery of the ozone layer" and that "environmentally sound alternative substances and technologies are available for virtually all HCFC applications" and urging "all Parties of the Montreal Protocol to consider all ODS replacement technologies, taking into account their global-warming potential, so that alternatives with a high contribution to global warming should be discouraged where other, more environmentally friendly, safe and technically and economically feasible alternatives or technologies are available."). A holistic approach to regulating ODSs and their alternatives is also consistent with guidance from the U.N. Conference on Environment and Development which calls on the Parties to "[r]eplace CFCs and other [ODSs] consistent with the Montreal Protocol, recognizing that a replacement's suitability should be evaluated holistically and not simply on its contribution to solving one atmospheric problem or environmental problem." U.N. Conference on Environment and Development, Agenda 21, at § 9.24 (June 1992).

[78] *See generally supra* note 14, Report of the 19th MOP; *see also id.* at Decision XIX/6, Decision XIX/12, and Decision XIX/20. Regulating high-GWP HFCs is essential to preserving the climate change mitigation benefits of the 2007 accelerated phase-out of HCFCs under the Montreal Protocol—which has the potential to prevent 12-15 Gt CO_2-eq. emissions by 2040—by ensuring the substances that replace HCFCs are as climate friendly as possible. *See supra* note 3, TEAP RESPONSE at 8; *see also supra* note 2, Velders et al. 2009 at 2. In advance of this decision to accelerate the phase-out of HCFCs, world leaders, in the *G8 Summit Declaration*, also pledged to manage HCFC substitutes under the Montreal Protocol to benefit the climate system. *See* G8 Summit Declaration (7 June 2007), http://www.whitehouse.gov/g8/2007/g8agenda.pdf ("We will also endeavor 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."). This pledge was echoed in the 2008 *Declaration of Leaders Meeting of Major Economies on Energy Security and Climate Change*. *See* Declaration of Leaders Meeting of the Major Economies on Energy Security and Climate Change, (9 July 2008), http://www.whitehouse.gov/news/releases/2008/07/20080709-5.html ("We, the leaders of … the world's major economies … recognizing the need for urgent action … commit to taking the actions in paragraph 10 without delay. … To enable the full, effective, and sustained implementation of the [UN Framework] Convention [on Climate Change] between now and 2012, we will: … promote actions under the Montreal Protocol on Substances That Deplete the Ozone Layer for the benefit of the global climate system.").

[79] *See supra* note 3, Report of the 20th MOP at Decision XX/8; *id.* at Preamble ("*Noting* that the transition from, and phase-out of, ozone-depleting substances has implications for climate system protection, *Recognizing* that decision XIX/6 encourages Parties to promote the selection of alternatives to hydrochlorofluorocarbons to minimize environmental impacts, in particular impacts on climate, … *Recognizing further* that there is a need for more information on the environmental implications of possible transitions from ozone-depleting substances to high-global warming potential chemicals, in particular hydrofluorocarbons …").

[80] Under international law, the Parties also have the power to issue a statement of interpretation of the Ozone Convention and Montreal Protocol to reaffirm their obligation to protect the climate system by regulating ODS substitutes through a decision at the 22nd Meeting of the Parties this November. *See supra* note 75, Vienna Convention on the Law of Treaties at Art. 31(3)(a).

[81] *See* United Nations Framework Convention on Climate Change, 31 I.L.M. 849 (9 May 1992) [hereinafter UNFCCC] at Arts. 2-3.

[82] *Id.* at Art. 7(2)(l) (emphasis added).

[83] *See supra* note 29, Kyoto Protocol at Art. 2(2).

[84] *See supra* note 5, HFC 2009 Amendment.

[85] Under international law, the Parties also have the power to issue a statement of interpretation of UNFCCC or the Kyoto Protocol in response to international developments affecting the terms of their treaty. *See supra* note 75, Vienna Convention on the Law of Treaties at Art. 31(3)(a).

[86] *See supra* note 8, Montreal Protocol at Art. 7.
[87] *See supra* note 5, 2009 HFC Amendment, at 19 – 20 and 25 – 27.
[88] *See id.* at 11 – 13, 19 – 20, and 25 – 27.
[89] *See supra* note 82, UNFCCC at Art. 4.
[90] *See supra* note 85-86.
[91] *See supra* note 29, Kyoto Protocol at Annex B.
[92] *Id*. at Art. 3 and Annexes I and A.
[93] *See supra* note 3, Report of the 20th MOP at Decision XX/8.
[94] *See supra* note 5, 2009 HFC Amendment.
[95] *See* 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) at http://ozone.unep.org/Meeting_Documents/oewg/29oewg/letter_from_USA_on_HFCs.pdf (last visited June 22, 2009).
[96] UNFCCC, SUBMISSION BY THE CZECH REPUBLIC ON BEHALF OF THE EUROPEAN COMMUNITY AND ITS MEMBER STATES (28 Apr. 2009), at ¶¶ 38 (since the accelerated phase-out of HCFCs mandated under the Montreal Protocol may further add to a rapid increase in the use of HFCs, many of which are very potent GHGs, the EU proposes that the Copenhagen agreement include an international emission reduction arrangement for HFC emissions") and 45 ("other international organizations and processes" are specifically listed as a means of implementation).
[97] *See generally supra* note 5, 2009 HFC Amendment.
[98] *See id.* at 28.
[99] *See* Executive Committee of the Multilateral Fund for the Implementation of the Montreal Protocol, Fifty-Seventh Meeting, at Decision 55/2, *Facility for Additional Income from Loans and Other Sources*, (30 March–3 April 2009).