Strengthening the Montreal Protocol by Promoting the Destruction of ODS Banks

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INTRODUCTION

As leading scientists warn that climate change is occurring earlier than originally predicted, with the threat of both linear and abrupt non-linear impacts, citizens and governments are aggressively pursuing all economically and technically feasible measures to reduce emissions of greenhouse gases ("GHGs") and other climate forcing agents. Paramount among these measures is the opportunity to prevent emissions of significant quantities of ozone-depleting substances ("ODSs") from existing stockpiles and from discarded products and equipment. These ODSs also are powerful GHGs. They are not included in the Kyoto Protocol basket of gases nor controlled by the Montreal Protocol on Substances the Deplete the Ozone Layer ("Montreal Protocol").

The Parties to the Montreal Protocol are preparing to take another important step towards better ozone layer protection and climate change mitigation based on proposals from Argentina, the Federated States of Micronesia, and Mauritius to promote the destruction of ODS banks.[1] These proposals seek to recover and destroy ODSs, such as chlorofluorocarbons ("CFCs") and hydrochlorofluorocarbons ("HCFCs"), before they are emitted from existing stockpiles and from discarded products and equipment, and before they harm the ozone layer and climate system.

Most ODSs are powerful climate forcing agents with a high global warming potential ("GWP"). From 1990 to 2010, the Montreal Protocol will have reduced ODS emissions by a net of 135 billion tonnes of carbon-dioxide equivalent ("CO_2-eq."), delaying climate forcing by up to 12 years.[2] Last year, the Parties to the Montreal Protocol accelerated the phase-out of HCFCs, which has the potential to reduce ODS emissions by a further 16 billion tonnes of CO_2-eq. and accelerate the recovery of the ozone layer by up to 3.3 years.[3]

Recognizing the continued contribution of the Montreal Protocol to protecting the climate system, in July 2008 the leaders of the world's major economies pledged to continue to support climate mitigation through the Montreal Protocol in the *Declaration of Leaders Meeting of Major Economies on Energy Security and Climate Change*, declaring:

> 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.[4]

The pending proposals are the first opportunity for the Parties to deliver on this pledge and, once again, to reap a double dividend on climate mitigation and ozone protection by strengthening the Montreal Protocol to address emissions from ODS banks. The potential climate mitigation from the pending proposals could prevent up to 6 or more billion tonnes of CO_2-eq. emissions by 2015.[5] The ozone benefits could accelerate the recovery of the ozone layer by up to 2 years.[6] This fast-action mitigation will also help buy time to develop mid- and long-term solutions to climate change and avoid passing the thresholds, or "tipping points," for abrupt and irreversible climate changes. This strategy is complementary to, and not a substitute for, strategies to address CO_2 emissions.

1. DESTROYING ODS BANKS WILL GENERATE SIGNIFICANT OZONE BENEFITS.

According to the Technology and Economic Assessment Panel ("TEAP"), end-of-life measures across all sectors are consistent and significant contributors to savings in terms of ozone with potential cumulative savings of around 300,000 Ozone Depleting Potential ("ODP") tonnes.[7] Using current technologies, ODS banks in refrigeration, stationary air conditioning ("SAC"), and mobile air conditioning ("MAC") equipment are the easiest and most cost efficient to recover and destroy and are considered "reachable" by the Multilateral Fund ("MLF").[8] If non-Article 5 ("non-A5") Parties act to recover and destroy only these reachable banks, the Parties could prevent the release of a potentially significant amount of the 194,038 tonnes of CFCs and 454,887 tonnes of HCFCs that will otherwise be emitted from these banks by 2015.[9] If the Parties assist Article 5 ("A5") Parties to recover and destroy these ODS banks, they can prevent a potentially significant amount of the 264,972 tonnes of CFCs that will otherwise be emitted from these banks by 2015.[10] These are meaningful ozone benefits, and destruction of all banks in refrigeration, SAC, and MAC equipment at end-of-life as of 2008 could accelerate the return of the ozone layer by up to two years.[11]

2. DESTROYING ODS BANKS WILL GENERATE SIGNIFICANT CLIMATE BENEFITS.

According to the TEAP, end-of-life measures across all sectors are again consistent and significant contributors to savings in terms of climate, with potential cumulative savings of approximately 6 billion tonnes of CO_2-eq.[12] By recovering and destroying only their reachable banks in refrigeration, SAC, and MAC equipment, non-A5 Parties can prevent the release of a potentially significant amount of the approximately 2 billion tonnes of CO_2-eq. CFCs and 770 million tonnes of CO_2-eq. HCFCs that will otherwise be emitted from these banks by 2015.[13] If the Parties assist A5 Parties to recover and destroy these ODS banks, the Parties can prevent the release of a potentially significant amount of the approximately 2.8 billion tonnes of CO_2-eq. CFCs that will otherwise be emitted from these banks by 2015.[14] The climate mitigation potential of destroying these reachable banks compares favorably to the reductions sought under the entire first phase of the Kyoto Protocol.[15] Destroying existing stockpiles of ODSs already recovered from applications will add further climate benefits beyond these estimates.

3. IMMEDIATE ACTION IS NEEDED TO REALIZE THESE OZONE AND CLIMATE BENEFITS.

Action now will provide cost-effective benefits that will not be available later. The TEAP has identified technically and economically feasible end-of-life measures and has concluded that "the main mitigation strategies likely to have effect on ODS emissions … as of 2008 … are those associated with end-of-life measures in refrigeration and mobile and stationary air-conditioning."[16] However, this window of opportunity is rapidly closing. The TEAP estimates that by 2015, approximately 90% of the CFCs and 50% of the HCFCs in reachable refrigeration, SAC, and MAC banks in non-A5 Parties, and over 75% of the CFCs in these banks in A5 Parties, will have been emitted.[17]

Currently, the Parties are not required to destroy ODS banks under the Montreal Protocol.[18] Only ODS production and consumption phase-outs are mandated under the Montreal Protocol: no financing or incentives for ODS bank destruction are provided. This must be changed in order to capture the ozone and climate co-benefits readily available to the Parties.[19]

In 2008, the Parties will determine the MLF's replenishment for the 2009-2011 triennium. ODSs in banks are currently being emitted and will continue to be emitted during the interim between the financing of ODS bank recovery and destruction pilot projects and the time when a comprehensive and efficient global program is implemented.[20] If funds are not, at a minimum, allocated to finance pilot projects for the recovery and destruction of ODS banks, a significant amount of easily recoverable and destroyable ODSs will be emitted before future funding and a comprehensive program can be put in place. The strategies and investments necessary to destroy the remaining banks of ODSs will take time to implement, and delaying these actions would be a missed opportunity for a double dividend on ozone layer and climate protection.

Additionally, significant quantities of HCFCs in A5 Parties will need to be properly disposed of for decades to come.[21] When the Parties later decide to aggressively pursue destruction of the significant HCFCs in A5 Parties' reachable banks, the same investments in infrastructure and governance institutions required right now will be required at that time as well.

4. THE MLF MUST FINANCE COST-EFFECTIVE ODS BANK DESTRUCTION ACTIVITIES IN A5 PARTIES WHILE SOURCES OF COMPLEMENTARY OUTSIDE FUNDING ARE EXPLORED.

In the near-term, ODS bank destruction in A5 Parties must be funded through the MLF in order to gain the experience and expertise necessary to expand ODS bank destruction activities in the mid-term. A5 Parties will need financial assistance, technology cooperation and transfer, coordinated logistics, and voluntary partnerships with companies that manufacture and market ODSs, in order to develop and maintain adequate reporting and record-keeping systems, train technicians to recover ODSs in banks, store ODSs awaiting destruction, build new ODS destruction facilities, enable facilities

currently operating as cement kilns and waste incinerators to destroy ODSs, and transport ODSs to destruction facilities within or outside the host country. By starting this process now, the Parties can assess the economic and technical feasibility of recovering and destroying reachable ODS banks and decide how best to strengthen their efforts in the next replenishment cycle, as well as possibly attract outside complementary funding by creating certainty regarding the costs and benefits of ODS bank destruction.

One possible source of complementary outside funding is to harness the climate mitigation benefits of ODS bank destruction to generate financing for ODS bank destruction activities in A5 Parties through appropriate GHG trading platforms. Most GHG trading platforms, including the Clean Development Mechanism ("CDM") under the Kyoto Protocol, do not presently have an approved ODS destruction methodology to generate emissions credits.[22] Under current CDM rules, an international body, such as the Montreal Protocol, may apply to coordinate a Programme of Activities ("PoA") comprised of numerous CDM programmes of activities ("CPAs") to generate Certified Emissions Reductions ("CERs").[23] Such coordination could generate significant funds through the sale of CERs—creating funding that can then be distributed through the MLF on traditional terms to A5 Parties to further ODS bank destruction.[24] Manufacturers of ODSs and equipment that use ODSs also could be asked to pay their fair share of the cost for recovery and destruction.

"Under the [MLF], the finance made available for phase-out is typically capped at US $15/kg for CFC-11."[25] In some instances, the total costs[26] of recovering and destroying ODS banks will be under this threshold and will be as cost-effective as traditional measures funded by the MLF.[27] In other instances, recovering and destroying ODS banks may be greater than traditional measures funded by the MLF, although they will be justified by the added climate value, which may also provide supplementary funding to bring the cost below the US$ 15/kg threshold.[28] Cost-effectiveness will also depend on cooperation among citizens, companies, and governments to implement strategies that achieve economies of scale, logistical efficiency, and competitive pricing of necessary services, particularly transport and destruction.

5. NON-A5 PARTIES SHOULD INCORPORATE AVAILABLE BEST PRACTICES FOR ODS BANK DESTRUCTION REINFORCED BY A LEGAL MANDATE.

Though some non-A5 countries have taken the lead in ODS bank destruction, no non-A5 country is currently implementing all of best practices currently in use. Successful programs include creating economic incentives (or, at least, removing disincentives), rebates on the return of used ODSs, ODS levies on production and import, municipal taxes, government-mandated producer responsibility schemes, and volunteer industry recycling and destruction programs.[29] These programs have demonstrated that ODS banks, as well as banks of high-GWP ODS replacements such as hydrofluorocarbons ("HFCs"), can be destroyed cost-effectively when the appropriate regulatory approaches and incentives are in place.[30] Almost all non-A5 Parties can dramatically increase the amount of ODS banks they destroy by implementing the best practices already in use in other non-A5 Parties.

6. THE PARTIES MUST ALSO ADDRESS LESS ACCESSIBLE ODS BANKS THROUGH RESEARCH.

After 2015, foams used for insulation in buildings will represent the largest remaining ODS banks,[31] and not all can be recovered and destroyed cost-effectively.[32] Thus, the Parties should encourage the development of more cost-effective means of recovering and destroying existing banks in building foams so that the destruction of large quantities of these banks is achievable when building foams reach their end-of-life after 2015. The Parties also should encourage or mandate that future building foam installations use best practices, including utilizing existing technologies that enable installation of building foams in steel-faced sandwich panels that allow for cost-effective recovery at end-of-life.[33]

Endnotes

[1] The term "ODS banks" describes the total amount of ODSs contained in existing equipment, chemical stockpiles, foams, and other products not yet released into the atmosphere. *See* Intergovernmental Panel on Climate Change (IPCC), Technology and Economics Assessment Panel (TEAP), *IPCC/TEAP Special Report on Safeguarding the Ozone Layer and the Global Climate System: Issues Related to Hydrofluorocarbons and Perfluorocarbons* ("IPCC/TEAP 2005 Special Report"), at 9, (2005), *available at* http://arch.rivm.nl/env/int/ipcc/pages_media/SROC-final/SpecialReportSROC.html. The IPCC and TEAP estimate that in 2002 global ODS banks were equivalent to approximately 21 billion tonnes ("Gt") of carbon-dioxide equivalent ("CO_2-eq."), with approximately 40 percent installed in refrigeration, stationary air conditioning ("SAC"), and mobile air conditioning ("MAC"), and the remaining 60 percent in foams, medical aerosols, fire protection, and other sectors. *Id* at 9.

[2] *See* Velders, et al., *The importance of the Montreal Protocol in protecting climate*, 104 PROC. NAT'L. ACAD. SCI. 4814-19, (20 March 2007), *available at* http://www.pnas.org/cgi/content/abstract/104/12/4814. By 2010, the net reduction in radiative forcing from ODSs will be about 13% of the forcing due to accumulated emissions of CO_2 from human activities. The net CO_2-eq. emissions reductions will be several times that of the reductions sought under the first phase of the Kyoto Protocol.

[3] *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* ("TEAP Response"), at 8, (August 2007), *available at* http://ozone.unep.org/teap/Reports/TEAP_Reports/TEAP-TaskForce-HCFC-Aug2007.pdf ("Cumulative savings in climate terms from ODS emissions reductions are potentially in excess of 18 billion tonnes CO_2-eq. for the period to 2050 when phase-out is advanced by 15 years (Scenario 2). 3.5 billion tonnes CO_2-eq of this is attributable to avoided HFC-23 emissions, assuming that no HFC-23 mitigation strategy is otherwise in place (as is modelled by the baseline scenario)."); *id.* at 12 ("Evaluations using the approach previously adopted by the Science Assessment Panel to assess the influence of factors on ozone recovery (return to 1980 levels of EESC) show that accelerated HCFC phase-out can advance ozone recovery by up to 3.3 years based on a mid-latitude assessment.").

[4] Declaration of Leaders Meeting of the Major Economies on Energy Security and Climate Change, (July 2008), *available at* http://www.whitehouse.gov/news/releases/2008/07/20080709-5.html.

[5] *See supra* note 3, TEAP Response at 12.

[6] TEAP, *Supplement to the IPCC/TEAP Report* ("TEAP Supplement"), at x, (November 2005), *available at* http://ozone.unep.org/Assessment_Panels/TEAP/Reports/TEAP_Reports/teap-supplement-ippc-teap-report-nov2005.pdf ("Destruction of all banks in refrigeration and AC equipment as of 2008 (at end-of-life) could result in an estimated return of the [Equivalent Effective Stratospheric Chlorine or] EESC to 1980 values around the year 2046 [two years ahead of previous estimates].").

[7] *See supra* note 3, TEAP Response at 12.

[8] *See* Executive Committee of the Multilateral Fund for the 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 A5 Countries (Follow up to Decision 47/52), (20 March 2006), at 13, *available at* http://www.multilateralfund.org/files/48/4842.pdf; *see also* ICF International, *Study on the Collection and Treatment of Unwanted Ozone-Depleting Substances in A5 and Non-A5 Countries* ("MLF 2008 Study"), at 11, (May 2008), *available at* http://ozone.unep.org/Meeting_Documents/oewg/28oewg/ICF_Study_on-Unwanted_ODS-E.pdf.

[9] *See supra* note 3, TEAP Response at 27.

[10] *Id.*

[11] *See supra* note 6, TEAP Supplement at x.

[12] *See supra* note 3, TEAP Response at 12 ("Early retirement of equipment can provide an additional 130,000 ODP tonnes and 3.5-4 billion tonnes CO_2-eq. not accounting for energy efficiency benefits that might also accrue.").

[13] *See id.* at 27. Estimates of CO_2-eq. have been calculated based on the global warming potential (GWP) of CFC-12 and HCFC-22, the most common refrigerants found in these applications.

[14] *See id*. Estimates of CO_2-eq. have been calculated based on the GWP of CFC-12, the most common refrigerants found in these applications.

[15] The climate mitigation potential of recovering and destroying ODS banks is up to 6 billion tonnes of CO_2-eq., before accounting for complementary measures such as early retirement as well as improved energy efficiency benefits that might also accrue. *See supra* notes 5 and 12-14 and accompanying text. Kyoto's required emissions reduction target, in terms of CO_2-eq., is -5.8 percent of a baseline of 18.4 $GtCO_2$-eq. or -0.97 $GtCO_2$-eq. per year by 2008–2012, roughly 5 $GtCO_2$-eq. United Nations Framework Convention on Climate Change ("UNFCCC"), *Key GHG Data: Highlights from Greenhouse Gas Emissions Data for 1990-2003* (Nov. 2005), *available at* http://unfccc.int/files/essential_background/background_publications_htmlpdf/application/pdf/key_ghg_data_press_background.pdf.

[16] *See supra*, note 6, TEAP Supplement at ix.

[17] *See supra* note 3, TEAP Response at 27.

[18] *See* Meeting of the Parties to the Montreal Protocol, Decision XV/9(1), (2003) ("To recall that the Montreal Protocol does not require the Parties destroy ozone depleting substances.").

[19] In addition to making the necessary changes to the Montreal Protocol, several other international conventions, regional agreements and decisions, and national laws exist that may affect the movement of unwanted ODSs to countries with destruction facilities. The Montreal Protocol Secretariat will have to coordinate with the appropriate bodies within these agreements, most notably The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, to facilitate ODS bank destruction. *See supra* note 8, MLF 2008 Study at 14.

[20] For example, the construction of new ODS destruction facilities takes, at a minimum, 3 months, excluding the time required to secure sufficient funding, appropriate permitting in the host nation, and other bureaucratic delays. *See* Ministry of the Environment of Japan, *Revised Report of the Study on ODS Disposal Options in Article 5 Countries* ("Japan ODS Options in A5 Countries"), at 16, (May 2006), *available at* http://www.env.go.jp/en/earth/ozone/ods2006.pdf.

[21] *See supra* note 8, MLF 2008 Study at 12 ("Because the Montreal Protocol does not begin to cut the production and consumption of HCFCs in Article 5 countries until 2015, and because new HCFC equipment will continue to be placed on the market until 2030, the quantities of contaminated HCFCs that will need to be properly managed in Article 5 countries will grow for decades to come.").

[22] *See supra* note 8, MLF 2008 Study at 48 ("Currently, neither the MLF nor the CDM have specific mandates to conduct these activities, but a joint review could identify opportunities for coordination and/or joint guidance."). In addition to the CDM, other GHG trading platforms also may present opportunities for harnessing the climate mitigation benefits of ODS bank destruction to finance further ODS bank destruction activities, including the Chicago Climate Exchange which has already approved a methodology for generating emissions credits for certain ODS bank destruction activities. *See* Chicago Climate Exchange, CCX Ozone-Depleting Substances Destruction Offsets, *available at* http://www.theccx.com/docs/offsets/Ozone_Depleting_Substance_Protocol.pdf.

[23] CPAs can be coordinated by public or private entities, including international institutions, and involve multiple countries to aggregate numerous small-scale activities. *See* CDM Rulebook, A-Z Items > Programme of Activities > What is Programme of Activities, (2008), *available at* http://www.cdmrulebook.org/pageid/452. The benefits of a CPA include, *inter alia*, reduced transactional

costs and bureaucratic delays, the use of one approved methodology for hundreds or thousands of similar projects, and one entity, e.g. the MLF, coordinating and facilitating the various projects for improved efficiency and ensuring ODS bank destruction activities achieve the maximum ozone and climate benefits.

[24] Such a program could generate significant funding for future MLF ODS bank destruction activities because the cost of destroying 1 CO_2-eq. tonne of ODS in banks will, in certain instances, be significantly less than purchasing a CER on the carbon market. For example, if a bank of CFC-11, the most common refrigerant in refrigeration, SAC, and MAC, can be destroyed at a cost of US$ 23/kg, because of CFC-11's high GWP of 4,600, the cost of destruction is only US$ 5 per tonne of CO_2-eq.—well below the market price per CER on the EU European Trading Scheme ("EU ETS") market. The EU ETS market price per CER is expected to be in the US$ 32.30 – 36.70 range by December 2008. *See* Carbon Finance, *ITL link, EU ETS review key for 2008 prices*, (9 January 2008), *available at* http://www.carbon-financeonline.com/index.cfm?section=lead&action=view&id=10948&linkref=cnews. Thus, in this hypothetical roughly US$ 27 – 31 can be reinvested into the MLF to be distributed on traditional MLF terms without generating further CERs. Fortunately, ODS destruction costs using TEAP-approved destruction technologies ranges from US$ 2.75-11/kg—significantly lower than the figure used in the hypothetical equation given here and therefore could result in the generation of CERs for as little as US$ 1. *See supra* note 20, Japan ODS Options in A5 Countries at 15-36 and 42; *see also supra* note 1, IPCC/TEAP 2005 Special Report at 433.

[25] *See supra* note 6, TEAP Supplement at 38-39 (citing Jeffs, M., Ashford, P., Albach and Kotaji, *2004: Emerging Usage Patterns for HFCs in the Foams Sector in the light of Responsible Use Patterns*, PROC. OF THE EARTH TECH. FORUM, Washington, (April 2004)).

[26] The costs and best methods for ODS bank destruction will vary with the particular ODS to be destroyed, the application of the ODS, the differing infrastructure and governance capacity of each country, and the possession of or proximity to ODS destruction facilities. The location of ODS banks will also be determinative in recovery costs, but the total costs will decrease after initial investments in infrastructure and training are made.

[27] The TEAP estimates that destruction costs for a variety of ODSs utilizing TEAP-approved destruction technologies will range from US$ 3.75-11/kg. *See supra* note 1, IPCC/TEAP 2005 Special Report at 433; *see also supra* note 20, Japan ODS Options in A5 Countries at 15-36 and 42 (estimating the cost of destruction ranges from US$ 2.75-11/kg).

[28] *See supra* note 24 and accompanying text.

[29] *See supra* note 8, MLF Study at 5, 25, 27, and 48. Both Australia and Canada have implemented producer responsibility programs for bulk ODS disposal. These programs are industry-run, collect and destroy bulk ODS, are funded by levies placed on the production/import of virgin/reclaimed ODS, and have been immensely successful. But Australia's program differs in several respects in that it is mandated by law, provides a rebate on the return of used refrigerant as opposed to permitting ODSs to be returned free of charge, and applies to all fluorocarbons, including HFCs, thereby enhancing its climate benefit and ensuring it remains capable of handling all refrigerants as industry moves from using CFCs to HCFCs to HFCs and other alternatives. However, Australia's program does not mandate the collection of foams in these applications which would increase the resulting ozone and climate benefits utilizing the existing governance institutions and infrastructure. Given the small refrigerant charge size of appliances, particularly refrigerators and freezers, non-A5 Parties should ensure the removal and destruction of ODS foam from domestic refrigerators and freezers in addition to the refrigerant. Collecting both refrigerant and foams will reduce cost per kilogram of ODS recovered by utilizing many of the same resources. *Id.* at 25. Japan has passed a law dealing with MAC ODS banks in vehicles and, in response, industry has implemented a recycling program under which end-of-life vehicles are sent to registered recovery operators, who recover ODS and are paid based on the number of MACs and quantity of refrigerant recovered. *Id.* at 2. "Because of the large and growing number of motor vehicles in operation worldwide, refrigerant recovery from [MACs] during service and disposal can be significant. Because MACs have relatively short lifetimes (roughly 12 -16 years) and have not been produced with ODS for many years, the number of MAC systems containing ODS is rapidly declining." However, since HFC-134a has replaced CFC-12 in this sector, the recovery of refrigerant from MACs will continue to be important from a climate perspective well into the future and can continue to utilize the system and infrastructure in place to dispose of CFC-12. *Id.* at 28.

[30] *See e.g.* Refrigerant Reclaim Australia, *Annual Report 2006-2007*, (2007), *available at* http://www.refrigerantreclaim.com.au/AR06/assets/RRA35299_AR_0607.pdf.

[31] The cumulative foam bank in 2015 will be approximately 9 $GtCO_2$-eq. *See supra* note 3, TEAP Response at 17 and 46.

[32] *See* TEAP, *Report of the Task Force on Foam End-of-Life Issues – Volume 3*, at 6 (May 2005), *available at* http://ozone.unep.org/teap/Reports/TEAP_Reports/TEAP-May-2005-Vol-2-Forms-End-of-Life.pdf ("[I]t has been estimated for modelling purposes that 20% or less of the currently installed building insulation will be available for recovery and destruction through technically and economically viable means. The one exception to this is the case of steel faced sandwich panels where … [t]rials are already in progress to establish the costs of recovery and destruction of the blowing agent in such panels, and there is expectation that there will be no fundamental technical or economic barriers to either mechanical recovery or direct incineration methods.").

[33] *Id.* at 7 ("For … steel faced sandwich panels, the situation is far more straight-forward. Infra-structure is already established in key areas of the world and commercial evidence suggests that recovery at $25-40/kg of blowing agent is already an achievable goal. The challenge has been to keep capacity investment (mostly in mechanical recovery) and demand in balance in a fast-moving market environment. Where regulation has been used to encourage the development of such markets, enforcement remains a challenge. Currently, typical efficiencies of collection are believed to be in the 50-65% range although they are generally still improving."); *see also supra* note 1, IPCC/TEAP 2005 Special Report at 344 ("[I]t is apparent that some building elements (e.g. steel-faced panels) could be managed technically and economically…The specific advantage associated with panels is that they could be managed using the plants already established for refrigerators.").