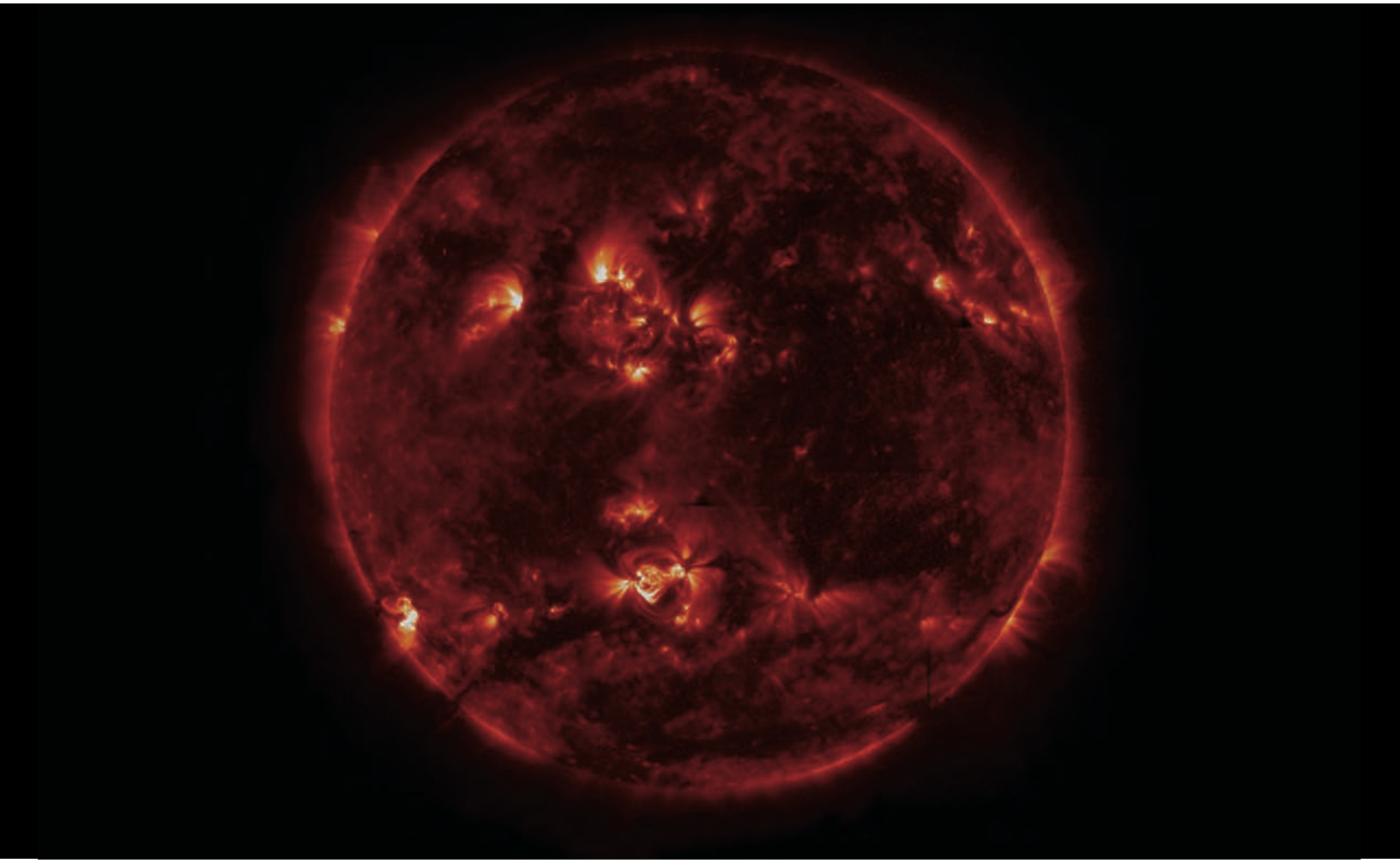
THE MONTREAL PROTOCOL IN 2010

MAXIMIZING CLIMATE BENEFITS FROM OZONE PROTECTION

22ND MEETING OF THE PARTIES TO THE MONTREAL PROTOCOL
ON SUBSTANCES THAT DEPLETE THE OZONE LAYER

NOVEMBER 8–12, BANGKOK



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MONTREAL PROTOCOL ON SUBSTANCES THAT DEPLETE THE OZONE LAYER

22ND MEETING OF THE PARTIES 2010

The Montreal Protocol has reached a critical stage in its evolution. Originally tasked with a singular focus on restoring the Earth's ozone layer, Parties must now consider the larger consequences of ozone depleting substances (ODS) and ODS substitutes on climate change.

Ongoing efforts for ozone protection cannot be satisfied through reliance on chemicals and technologies that exacerbate global warming. Parties must amend and refine policies and decisions so that ozone and climate protection receive equal consideration, and actions to eliminate ODS also, to the maximum extent possible, limit greenhouse gas (GHG) emissions.

Beginning with the 2007 agreement to accelerate the HCFC phase-out, to MLF funded pilot projects for low-GWP alternatives, to the recent decision granting up to a 25% funding additionality for projects that achieve climate benefits (by transitioning to low-GWP alternatives rather than HFCs), the Montreal Protocol has already taken several important steps to integrate climate considerations into its decisions. The real question now is whether Parties will allow the Montreal Protocol to realize its full potential by permitting it to work as effectively for climate as it has for ozone recovery.

There are three distinct and enormous opportunities for the Montreal Protocol to take action on climate mitigation that must be considered at this years MOP, each with the potential to deliver greater GHG emissions reductions than the Kyoto Protocol will achieve through 2012, and at far lower cost: Amendment Proposals that would enable an HFC phase-out (88-140 Gts CO_2e); decisions on ODS Banks (16-17 Gts CO_2e); and, maximizing direct transitions to low-GWP alternatives during the HCFC phase-out (20+ Gts CO_2e). Additionally, there is a Decision Proposal to ensure destruction of non-CDM HFC-23 that would prevent 260+ Mts CO_2e from being emitted every year.

These are the most cost-effective high-yield GHG mitigation projects in the world. The Montreal Protocol is the definitive global authority and regulatory mechanism for industrial halogenated gases (those containing bromine, chlorine and fluorine). As these gases are currently responsible for one-sixth of all radiative forcing taking place in the atmosphere today, and given the urgent need for significant near-term GHG reductions, the Montreal Protocol must act to advance these ODS/GHG mitigation efforts at this year's Meeting of the Parties (MOP).

The breadth and magnitude of climate change ranks it as the gravest threat that humanity has ever faced. And while Parties may offer reasons why the Montreal Protocol cannot or should not act to enlarge its mandate to include limiting and eliminating GHG emissions from ODS, ODS substitutes, and ODS by-products, none of these reasons are adequate to excuse inaction. Restoring ozone layer at the expense of the global climate or failing to take action that will clearly reduce the threat of catastrophic climate change is hardly worthy of "the most successful environmental treaty in history".

The late Madhava Sarma stated at the 2009 MOP that the "climate disease" had infected the Montreal Protocol; he was dismayed by Parties using the Montreal Protocol as a forum to gain advantage or leverage within the UNFCCC climate negotiations. This 'prescription for inaction' will avail nothing and no one, and we urge Parties to acknowledge the opportunities that exist right now within the Montreal Protocol, stop making excuses, and move without further delay to advance the most significant measures for limiting greenhouse gas emissions ever taken in history.

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MAXIMIZING BENEFITS FROM THE HCFC PHASE-OUT

DELIVERING ON THE PROMISE OF MITIGATION

Adoption of the Accelerated HCFC Phase-out was celebrated as a major climate victory with estimates of prevented emissions as high as 18 Gts CO_2e and more between 2010 and 2050, depending on the amount of transition to climate-friendly alternatives and more energy efficient technologies.[1] The actual emissions reductions achieved from the HCFC phase-out will depend on how thoroughly the Montreal Protocol implements low-GWP conversions subsequent to the 2013 freeze date for production and consumption.[2]

The initial actions to implement the HCFC Phase-out in Article 5 countries do not bode well for achieving the promised climate gains. Under a business as usual (BAU) scenario, 77% of the conversions from HCFCs are projected to convert to HFC technologies using HFC404A, HCF410, HFC134a or HFC245fa.[3] The average GWP of these HFCs as a function of expected use is 1740. In order to realize the promised level of GHG mitigation, concerted efforts to transition all or nearly all HCFCs to low-GWP alternatives need to be implemented. This has not happened to date, with the Multilateral Fund (MLF) recently approving several major HFC projects to replace HCFCs. At this MOP, the Montreal Protocol must take the opportunity to recommit to maximizing the climate benefits of the HCFC phase-out by preventing a massive "Phase-in" of HFCs.

Right now the Montreal Protocol is at a crossroads. According to EIA calculations, making the right choices now can avoid emissions through 2050 of approximately 20 Gts CO_2e that will otherwise result from transitions to HFCs.[4]

With the filing of the HFC Phase-down Amendments, implementation of the Kyoto Protocol, and related legislation such as the EU F-Gas Regulation and MAC Directive, low-GWP alternatives are being developed and commercialized that could result in at least 80% conversion to low-GWP alternatives rather than 80% HFCs. This calculation is supported by the Technology and Economic Assessment Panel's (TEAP) 2010 *Assessment of HCFCs and* Oko Recherche's *2010 Preparatory study for the Review of Europe's F-gas regulation*.[5] Both studies document that alternatives are either already available or being developed in all key sectors.

Given that the Article 5 HCFC phase-out will primarily occur over the next twenty years, there is sufficient time to bring these alternatives into the market. Historically, the Montreal Protocol has always set schedules that inspire technical innovation, and by committing to maximize transitions directly from HCFCs to low-GWP alternatives, the HCFC phase-out should be no different.

The schedule for the HCFC phase-out in developing (Article 5) countries is the following:

2009-2010	Baseline;
2013	Final freeze on use and production;
2015	10% reduction from baseline;
2020	35% reduction from baseline;
2025	67.5% reduction;
2030	97.5% reduction; and
2040	100% phase-out

A massive Phase-in of HFCs can only be avoided by maximizing low-GWP conversions during the HCFC Phase-out.

Based on the HFC Phase-down proposals, for A-5 countries it is estimated that commercially viable and environmentally sound alternatives will be available for the following percentages of HFCs.

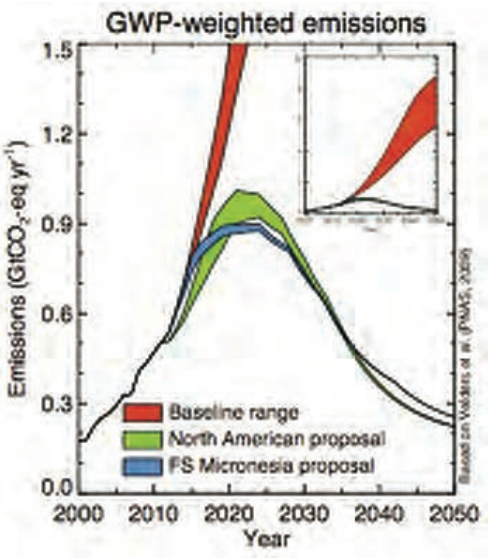
AVAILABLE LOW-GWP ALTERNATIVES

	FSM PROPOSAL	NA PROPOSAL
2015	15%	10%
2020	45%	30%
2025	70%	50%
2030	90%	70%
2040	90%	85%

Maximizing direct transitions from HCFCs to these low-GWP alternatives in the sectors where alternatives are available will result in dramatic climate benefits. The necessary actions for maximizing transitions to low-GWP alternatives are as follows:

1. Prioritize conversions to commercially available low-GWP alternatives;
2. Prioritize transitions to those sectors where low-GWP alternatives are commercially available;
3. Instruct implementing agencies to prioritize transitions to low-GWP alternatives;
4. Instruct the Executive Committee of the MLF to scrutinize each HCFC Phase-out Management Plan (HPMP) and further consult with countries where: a) an HFC transition is proposed where a low-GWP alternative is commercially available; or b) an HPMP contemplates conversions in a sector where low-GWP alternatives have yet to be commercialized when the country has HCFCs in other sectors where alternatives are commercially available that could be converted first. In such cases the MLF should consider amending the HPMP to prioritize the low-GWP alternative.
5. Ensure full funding is available for these low-GWP transitions.

Based on this approach more than 80% of all conversions in the HCFC phase-out could transition to low-GWP alternatives with cumulative emissions reductions of up to 20 Gts CO_2e. Given the current funding shortfall, the time required to implement these measures, and the fact that some countries



are already converting to HFCs, it is likely that only half of the first 10% step-down will convert to low-GWP alternatives. Beyond this it will be possible to make 100% conversions to low-GWP alternatives at each step-down, except the last where between 10-15% of HFCs are not predicted to have alternatives.

In addition, given there are HCFCs that are not eligible for funding under the incremental cost guidelines for the HCFC phase-out (such as HCFCs created after September 21, 2007, HCFCs created for uses that never used traditional ODS such as CFCs), the TEAP and Scientific Assessment Panel (SAP) should be requested to assess the potential climate benefits of transitioning these HCFCs to low-GWP alternatives and the associated incremental costs. The goal of the Montreal Protocol should be to transition all HCFCs possible to low-GWP alternatives, whether or not they are subject to the current funding guidelines approved by the ExCom.

The Montreal Protocol has the chance to achieve dramatic climate mitigation simply by preventing the "phase-in" of HFCs during the accelerated phase-out of HCFCs. If the Parties to the Montreal Protocol maximize transitions to low-GWP alternatives now, theoretically 100% of the reduction from 90% HCFC use to 10% HCFC use (the baseline for the HFC phase-down) can be transitioned directly to low-GWP alternatives. By doing this, the Montreal Protocol can avoid emissions of approximately 20 Gts CO_2e by 2050. It is likely that in some countries and in some sectors a 100% conversion rate will not be achievable, but a signal from the Montreal Protocol at this stage that there will be markets for low-GWP alternatives will greatly enhance the prospects for achieving 100% conversion to low-GWP alternatives in each succeeding step of the HCFC phase-out.

Low-GWP alternatives could be utilized in more than 80% of all HCFC conversions and achieve emissions reductions of up to 20 Gts CO_2e by 2050.

The Parties of the Montreal Protocol must act now to put the HCFC phase-out on schedule to maximize transitions to low-GWP alternatives and realize the climate mitigation heralded when the accelerated HCFC phase-out was announced. Taking these actions will once again demonstrate that the Montreal Protocol is the most effective multilateral environmental agreement in the world.

RECOMMENDATIONS

There are several key Decisions that the Parties must adopt to ensure that the MLF is directed to maximize transitions to low-GWP alternatives during the HCFC Phase-out:

- Request the TEAP to assess the percentage of Article 5 Parties that can transition directly to low-GWP alternatives, identify the sectors where direct transitions can occur, and quantify how many projects are transitioning to HFCs due to a lack of funding;
- Include in the Terms of Reference for the next replenishment a request that the TEAP evaluate the cost of maximizing direct transitions to low-GWP alternatives during the first step-down to 10% below the Baseline;
- Require the MLF to scrutinize each HPMP to assess if it is utilizing opportunities to transition to low-GWP alternatives and to require a consultation with the submitting country, the implementing agency and the MLF to reconsider low-GWP alternatives in submitting a revised HPMP.
- Direct the MLF to continue funding new low-GWP technology pilot projects that will accelerate the commercialization of alternatives to HFCs;
- Direct the MLF to provide sufficient funding, on a case by case basis, to transition an entire industrial sector, if necessary, for low-GWP alternatives to be incorporated into the HPMP, even if the transition of the entire sector achieves a greater transition than mandated by the HCFC phase-out schedule provided the excess is deducted from available funding in the next step-down phase;
- Direct the implementing agencies (UNEP, UNDP, UNIDO and the World Bank) to prioritize HCFC transitions in sectors where low-GWP alternatives have been commercialized and discourage transitions to HFCs in sectors where alternatives are not yet commercialized;
- Request the TEAP/SAP to a) assess the quantities of HCFCs in use that are not eligible for incremental funding under the HCFC phase-out guidelines and, b) assess the potential for transitioning these HCFCs to low-GWP alternatives; c) evaluate the climate benefits of transitioning these HCFCs to low-GWP alternatives, and d) estimate the incremental costs of transitioning these HCFCs to low-GWP alternatives.
- Adopt a replenishment that will facilitate the greatest number of transitions to low-GWP alternatives and encourage individual countries and/or the World Bank to contribute additional funding to the HCFC phase-out as a climate mitigation project;
- Request the TEAP to continue monitoring the availability and commercialization of low-GWP alternatives so that the HCFC phase-out takes full advantage of anticipated additional low-GWP alternatives and to assess whether there are other actions that can be taken to increase direct transitions to low-GWP alternatives approaching 100% in subsequent step-downs.

LOW-GWP ALTERNATIVES TO HCFCS/HFCS

DAWN OF A NEW ERA

In its 2010 "Assessment of HCFCs and Environmentally Sound Alternatives" the TEAP has demonstrated that, with supportive regulation, sufficient HFC-free alternatives exist or are being commercialized to allow Article 5 counties to meet the reduction requirements in the HCFC phase-out and avoid the need to transition to HFC-based technologies.[6]

Given the inherent difficulty in competing with and displacing established technologies and private industries, the degree of market penetration evidenced by systems utilizing low-GWP alternatives is clearly indicative of increasing global growth and viability of non-fluorinated or not-in-kind compounds and technologies.

The TEAP report suggests that remaining reductions in non-Article 5 countries can and should be made with non-HFC alternatives and that they should be investing and making appropriate regulatory changes to assist with the commercialization of low-GWP alternatives.

The development of HFC-free alternatives is already well established in certain sectors such as domestic refrigeration and foam, following their widespread use in non-Article 5 regions such as Europe. However the commercial refrigeration sector remains a critical challenge to avoiding the enormous predicted rise in HFC production and consumption. The TEAP's 2009 Task Force Decision XX/8 report estimates that by 2015 commercial refrigeration will account for 58% of the HCFC bank in developing countries.[7] Converting to low-GWP alternatives within the commercial sector will therefore be critical to successful implementation of the HCFC phase-out.



CO2 sub-critical supermarket cascade refrigeration system

LOW-GWP ALTERNATIVES TO HCFCS IN COMMERCIAL REFRIGERATION

STAND-ALONE UNITS

In its 2010 Assessment TEAP identified hydrocarbons and CO_2 as commercialized low-GWP alternatives to HCFCs, highlighting widespread use of these 'natural' refrigerants in equipment across Europe.[8] Additional research has shown that they are also entering markets within developing countries, e.g. Unilever has placed over 360,000 hydrocarbon based ice cream freezers globally, including in Latin America and Asia.[9] Long-term trials in Australia have shown a 9% reduction in energy use when these units are compared with HFC cabinets.[10] Clearly this is a sector where HCFCs can be replaced with energy efficient low-GWP alternatives.

SECTORS	LOW-GWP ALTERNATIVES IN USE	ENERGY EFFICIENCY OF LOW-GWP ALTERNATIVES VS. HIGH-GWP HFCS
Domestic refrigeration	Hydrocarbons (HC-600a)	Energy efficiency is comparable to HFC
Commercial refrigeration: Condensing units	CO_2, hydrocarbons (HC-290)	Energy efficiency of HC is comparable to HFC
Commercial refrigeration: Centralised systems, supermarkets	Ammonia/CO_2, hydrocarbons	Energy efficiency is comparable to HFC
Commercial refrigeration: Stand alone	Hydrocarbons, CO_2	Energy efficiency of HC can be comparable to HFC
Industrial refrigeration	Ammonia, CO_2, hydrocarbons	Energy efficiency is comparable to HFC. Efficiency of ammonia and HCs is +30% and +20% respectively
Industrial AC	Ammonia, CO_2, hydrocarbons	Energy efficiency of ammonia +20% compared to HFC
Industrial heat pumps	Ammonia, CO_2, hydrocarbons	Energy efficiency of ammonia +20% compared to HFC
Chiller AC: small recip. and scroll 10-1,600 kW	Hydrocarbons in systems <300 kW	Energy efficiency is comparable to HFC
Chiller AC: large recip. and screw 100-7,000 kW	Ammonia	Energy efficiency can be comparable to HFC
Chiller AC: centrifugal 10,500 kW	None identified by TEAP	
HCs are used in large chillers in the UK	Energy efficiency of HC +20% compared to HFC (info from Earthcare)	
Unitary AC: small self-contained AC	Hydrocarbons	Energy efficiency is comparable
Unitary AC: non-ducted split AC	Hydrocarbons	
HCs are used in large chillers in the UK	Energy efficiency is comparable	
Unitary AC: ducted split AC	None identified by TEAP	
Transport vessels, trucks, trailers	Ammonia, CO_2, cryogenics, eutectics	No data
Vehicle AC	CO_2 [not in commercial use]	Energy efficiency is comparable to HFC

CONDENSING UNITS

The 2010 TEAP report highlights the use of hydrocarbons, CO_2 and recent designs using ammonia combined with CO_2. TEAP estimates market penetration of low-GWP alternatives in developed countries to be about 7%, indicating that a considerable amount of non-HFC equipment is already available. There is also evidence suggesting that this figure is likely to significantly increase in the near future. Major UK food retailer Waitrose has committed to the use of hydrocarbon based condensing systems in all new stores and will phase out the use of HFCs completely by 2020.[11]

CENTRALIZED SYSTEMS

TEAP research shows that CO_2 is the preferred low-GWP alternative to HCFCs at low temperatures, but at medium temperature the options are less clear. Although the 2010 Assessment report highlights the use of hydrocarbons, ammonia and CO_2 as medium temperature options, it stops short of documenting the widespread commercialization of non-HFC systems globally. Retail giant Tesco has installed non-HFC systems in Thailand, Malaysia and Turkey, and has systems planned in Korea, Hungary and the US.[12] TEAP estimates market penetration of centralized systems in developed countries to be about 5%, however this is likely to rapidly increase as several UK supermarkets have recently announced ambitious HFC phase-out targets which will further increase the pace of technology change globally.[13]

Commercial decisions currently being made by supermarket retailers in Europe will have significant impacts on technology choices in developing countries, as retail giants Tesco and Carrefour have growing interests in Asian markets. Tesco's current focus is on South Korea, Thailand and Malaysia, with CO_2 based systems installed in all three countries.[14] Carrefour has hundreds of stores across seven Asian countries, with a focus on China, and is already installing CO_2 based systems for frozen foods across Europe in order to comply with the HCFC phase-out. Group Assets Director, Mr Brunet, has suggested that the roll-out of CO_2 based systems across Latin America and Asia could be speeded up if more contractors were trained.[15]

Low-GWP technologies within the commercial refrigeration sector are being rapidly commercialized. This is likely to be further enhanced by probable changes to European regulations regarding the use of HFCs in late 2011. In order to avoid the transition to HFC-based technologies developing countries should select an HCFC phase-out policy that does not lock the commercial refrigeration sector into HFCs.

TEAP DECLARES NATURAL REFRIGERANTS AS ENERGY EFFICIENT AS HFCS

In its May 2010 "Assessment of HCFCs and Environmentally Sound Alternatives" TEAP found that low-GWP alternatives to HCFCs are as energy efficient as HFC systems in many sectors. Depending on the situation, CO_2 can be comparable or less energy efficient than HFC. However, the energy efficiency of hydrocarbons and ammonia is comparable to HFC in most cases and low-GWP alternatives actually provide substantially greater efficiency than HFCs in several sectors:

- In industrial sectors (industrial refrigeration, AC and heat pumps) ammonia is about 20% more energy efficient than HFCs.
- In industrial refrigeration hydrocarbons are about 20% more energy efficient than HFCs.

These findings show that the old industry argument that HFCs are more energy efficient than natural refrigerants has finally

been laid to rest. Clearly the focus therefore should be to minimize GWP given that natural refrigerant technologies no longer involve significant energy penalties and in many cases demonstrate greater energy efficiency than HFC systems.

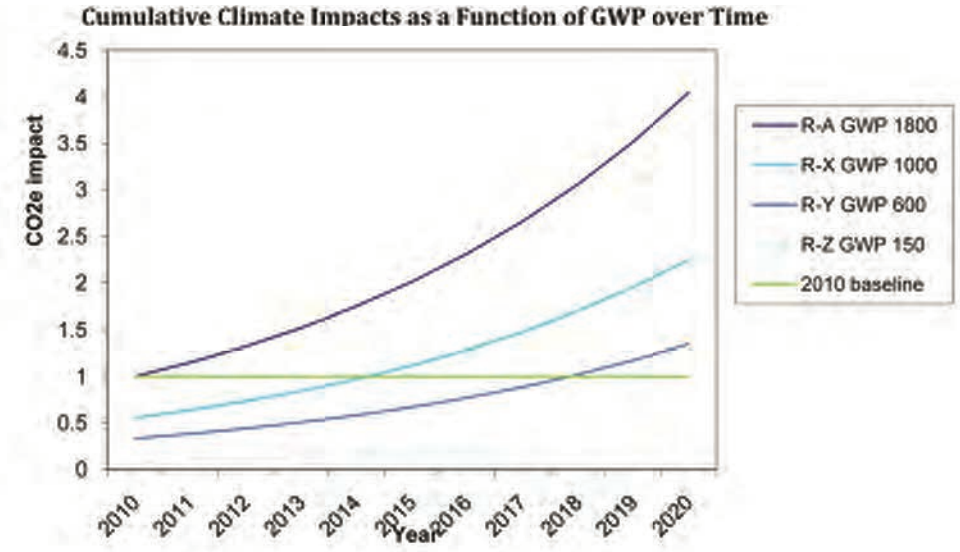
DEFINING LOW GWP ALTERNATIVES TO HCFCS

EIA is gravely concerned by the TEAP's approach to GWP classification outlined in the 2010 "Assessment of HCFCs and Environmentally Sound Alternatives" in which it states "It is clear that in this case the link to climate related science is missing."[16] Of most concern are the proposed demarcations of "moderate" and "low" GWP. The acceptance of "moderate" GWP at < ~1000 and "low" GWP at < ~300 could be used to justify alternatives with significant climate impacts that will eventually need to be phased out, while diverting resources and regulatory efforts away from available and true low-GWP alternatives.

As demonstrated in Figure 1. a transition to high or intermediate GWP alternatives will have limited benefits for climate and therefore all available resources should be dedicated to commercializing the alternatives in all sectors and subsectors that have the lowest GWP (taking into account ozone depletion, health, safety, and affordability). Clearly, the Montreal Protocol should commit its financial and technical resources to truly low-GWP alternatives so that redressing ozone depletion does not come at the expense of climate.

EIA is particularly concerned about the 'moderate' GWP demarcation of approximately 1000. HFC-134a has a GWP of 1,400 and is being banned from use in mobile air-conditioning across Europe. However under the TEAP's classification this could be a 'moderate' GWP, which implies that its use is acceptable. Tacit acceptance of this categorization risks endorsing HFCs with GWPs that are by current standards rightly considered too high and undesirable.

Any definition of 'high' and 'low' GWP must take into account soaring HFC growth rates



Benefits accrued from transitioning to substitutes with lower GWPs before climate impacts exceed a 2010 emission baseline

in developing countries. Figure 1 plots the CO_2e impact of refrigerants with various GWPs. The CO_2e impact of Refrigerant 'A' consumption (GWP of 1800) in 2010 is given a value of one and is used as a baseline/index to which the CO_2e impacts of three other refrigerants with varying GWPs are compared. Figure 1. assumes continued refrigerant growth rates of 15% up to 2020, as documented in developing countries between 2002 and 2008.[17]

The graph compares the CO_2e impacts of adopting various refrigerants given current growth rates. The purpose is to assess how much benefit will be accrued from a reduction in GWP before the CO_2e impact exceeds 2010 emissions by the baseline/index for refrigerant 'A' with a GWP of 1800.

Using this tool it is apparent that based on current growth rates, an immediate reduction to a refrigerant with a GWP of 1000 in 2010 would allow just 4 years before CO_2e impacts levels return to baseline. For a refrigerant with a GWP of 600 the delay is 8 years. A significant difference is evident when a refrigerant with a GWP of 150 is used. In this case, baseline levels do not return until 2036, some 26 years later. Clearly there are significant and detrimental climate impacts associated with so-called "moderate" or "low" GWPs of 1000 and 300 respectively.

For a number of years, the term 'Low-GWP alternatives' has conventionally been used in MLF and other fora to describe ammonia, hydrocarbons (HC), CO_2 and water, i.e. substances with a GWP less than ~20. Several published reports have also used the term 'Low-GWP' for refrigerants with a GWP less than ~20, or have used GWP 20 as a threshold.[18]

Even though no formal definition has been adopted for the term 'low-GWP', EIA recommends it is used to denote refrigerants with a GWP less than ~20. The MLF and Parties should adopt this definition officially.



R-744 (CO2) canisters

A COMPREHENSIVE PLAN TO EFFECTIVELY DESTROY ODS BANKS

The window of opportunity for reaping the double dividend for ozone and climate protection is rapidly closing.

Historically, the Montreal Protocol has only controlled the production and consumption of ODSs,[19] and as a result 'Banks' of ODSs have accumulated in three primary end-use sectors: refrigeration, air conditioning and foams.[20] These ODS Banks are not currently subject to any control measures under the Montreal Protocol, or the UNFCCC and the Kyoto Protocol.[21]

According to the IPCC and TEAP, in 2010 ODS Banks contained approximately 16-17 Gts CO_2e across all sectors worldwide, consisting of 12 Gts CO_2e of CFCs and 4-5 Gts CO_2e of HCFCs.[22] This is a decrease of 4-5 Gts CO_2e from the TEAP's 2002 estimate, and demonstrates that every year the Montreal Protocol fails to take action on Banks, hundreds of millions of CO_2e tonnes are emitted to the atmosphere.

Banks must be regulated to avoid severe climate consequences, as well as a significant delay in the restoration of the ozone layer and abatement of the enormous related medical and environmental consequences. In response to this challenge, Parties have filed six draft decisions for consideration at the 22nd Meeting of the Parties (MOP) in Bangkok that together could create a comprehensive approach to Banks collection, containment and destruction.[23]

While destruction of Banks represents one of the most cost-effective climate mitigation strategies, the window of opportunity for reaping this double dividend for ozone and climate protection is rapidly closing:

- Developed Countries/Non-Article 5 Parties: TEAP estimates that approximately 72% of CFCs and 40% of HCFCs in refrigeration and air conditioning Banks will be emitted during the period from 2010 to 2015, releasing 0.7 Gts CO_2e of CFCs and 0.6 Gts CO_2e of HCFCs.[24]
- Developing Countries/Article 5 Parties: TEAP estimates that over 65% of the CFCs in refrigeration and air conditioning, constituting 1.7 Gts CO_2e will be emitted during 2010-2015. In addition, although HCFC consumption is decreasing among non-Article 5 Parties, HCFC consumption among Article 5 Parties will continue to rise through 2012. TEAP estimates that HCFC refrigeration and air-conditioning Banks in Article 5 Parties will increase by 11% over the 2010-2015 period, to approximately 2.36 Gts CO_2e in 2015.[26]

Based upon the TEAP reports, the Parties in draft Decisions XXII [J] & [L] have recognized that any opportunity for action on easily and cost-effectively recoverable Banks will be gone by 2020. In order for a Banks program to be comprehensive, it must address Banks destruction by all Parties, it must consider how to deal with low-volume consuming countries, and it must adequately deal with the substantial costs of destruction. The Parties need to immediately adopt a program that actually implements destruction and does not merely continue to study the issue until all 16-17 Gts CO_2e of Banks have been emitted to the atmosphere. Parties should support the actions and financing options listed below that are drawn from the pending decisions plus an additional funding option:

RECOMMENDATIONS

I. INFRASTRUCTURE FOR BANKS DESTRUCTION:

- In the Terms of Reference (TOR) for the next replenishment, the TEAP should be requested to evaluate the cost of conducting activities such as national inventories of the size, type and location of Banks, and the development of legislative frameworks and strategies for sound management of Banks from collection to destruction in Article 5 countries;
- Non-Article 5 countries should be requested to immediately create national inventories of the size, type and location of Banks and to develop legislative frameworks and strategies for sound management of Banks from collection to destruction;
- Parties and Stakeholders should be encouraged to create extended responsibility schemes in which producers and importers of ODS and products containing ODS become responsible for collection, management and disposal at the end of ODS or products' containing ODS lifetimes;
- Parties and Stakeholders should be encouraged to develop and implement new ways to provide incentives for the collection and destruction of Banks;
- The Executive Committee should be directed to develop criteria by its 66th Meeting on components and elements that should be part of national strategies for Article 5 Parties for the collection, management and disposal of ODS, and the levels of funding required to implement such strategies;
- The TEAP should be requested to assemble all available data from the Banks destruction pilot projects funded

by the MLF and any other Banks destruction projects funded by private or public sources by the 2011 OEWG, so that all Parties have access to the latest data on which Banks destruction projects have proven effective and which ones have not.

II. FINANCING:

1) THE NEXT REPLENISHMENT

In order to address Banks within the timeframe necessary to prevent massive GHG emissions immediate financing needs for Banks must be included in the next replenishment. To accomplish this, the TEAP should be requested in the TOR for the next Replenishment to:

- Assess the funds required to undertake cost-effective Banks destruction projects during the next replenishment, (Article 5 countries should be encouraged to identify for the TEAP Banks destruction projects that are still awaiting funding); and,
- Evaluate the costs of the components that the Executive Committee determines should be part of national strategies for Article 5 Parties for the collection, management and disposal of ODS.

2) FUNDING FROM INTERNATIONAL FINANCIAL ENTITIES

- Parties should seek funding for collection, management and destruction of Banks from the Global Environmental Fund (GEF) and other international financing agencies, and explore opportunities for collaboration with energy efficiency programs and other fora that utilize broad strategies for the management of hazardous chemical substances including persistent organic pollutants.
- Parties should work with the GEF and other international financing agencies to have Banks destruction authorized as an approved project for funding in its own right.

3) VOLUNTARY CARBON MARKETS

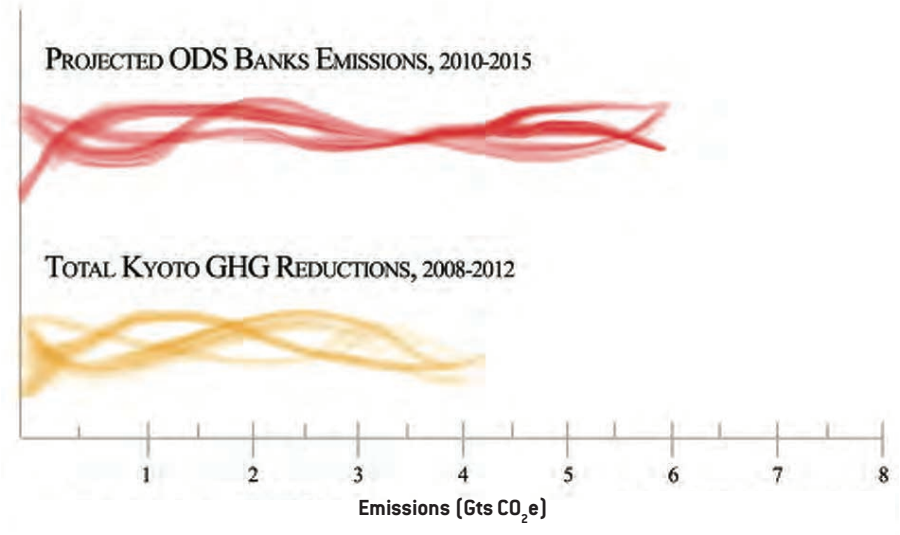
- To the extent that ODS Banks destruction is not included in a national legislative framework strategy for sound management of Banks, and is not included in an extended responsibility scheme implemented by producers or stakeholders, Parties should consider accessing the voluntary carbon markets to finance Banks destruction.
- To the extent that voluntary carbon markets can add a valuable contribution to Banks destruction, criteria, monitoring and verification measures should be developed to enable crediting for Banks destruction that is performed internationally.
- Banks destruction projects for voluntary carbon markets should only cover those ODS that have been phased out. HCFCs should not be eligible due to the risk of illegal trade and a perverse incentive for creating HCFCs simply to destroy them for carbon credits.

MANDATORY CARBON MARKETS

The only viable way to raise the funds required to recover and destroy a significant portion of Banks is to have ODS Banks destruction approved for crediting in mandatory carbon markets, such as the UNFCCC's Clean Development Mechanism (CDM), the European Trading Scheme (ETS), and new markets being created such as California's Climate Action Registry. Upon initial approach, the CDM rejected the Montreal Protocol's attempt to add Banks destruction to its list of approved methodologies. The approach was made in the year prior to Copenhagen and the CDM is now undergoing a thorough review to determine how it will be operated post-2012. The Secretariat should be requested to make another submission to the CDM as well as other prominent mandatory carbon markets to see if they will accept Banks destruction for crediting. Three voluntary markets have developed methodologies to ensure verifiable Banks destruction, the use of which could convince mandatory markets to embrace Banks destruction.

The political atmosphere surrounding the climate negotiations and the CDM Executive Board has created an environment where the CDM Executive Board may react with undue caution to a groundbreaking proposal from any entity to include ODS (non-Annex A GHGs) under the CDM without guidance from the Parties.[27] With its reputation and the nearly complete overlap of Parties to the Montreal Protocol and UNFCCC, the Montreal Protocol is uniquely positioned to communicate and coordinate directly with the UNFCCC to secure the consideration required to advance a CDM program for ODS Banks destruction.

The institutions, mechanism, and entities established under the Montreal Protocol, particularly the MLF, should have a central role in facilitating the management of ODS Banks destruction within mandatory carbon markets. The MLF and TEAP are the only entities with the requisite expertise, infrastructure, governance institutions, and



existing relationships with national ozone offices to cost-effectively destroy ODS Banks in the near-term.

It is imperative that ODS banks destruction via any carbon market mechanism has a net climate benefit, i.e that for every CO_2e tonne of ODS destroyed, significantly less than one carbon credit is generated. It should be remembered that carbon markets are traditionally a means of displacing and not reducing global GHG emissions as every offset sold enables increased emissions in certain developed countries. In order to achieve this, a heavy discounting factor must be applied to ODS credits. If the MLF were undertake the role of ODS Bank destruction facilitator it could do this by using profits generated by the sale of a limited number of CERs to fund further banks destruction without selling these credits onto carbon markets.

III. DESTRUCTION OF OZONE-DEPLETING SUBSTANCES:

In order to effectively address Banks, the Montreal Protocol needs to ensure that there are adequate destruction facilities and that criteria are established for the handling and destruction of ODS that can be implemented globally. More information is needed from the TEAP by the 2011 OEWG meeting on the following topics:

- The development of criteria for a uniformly applied minimum standard for the handling and destruction of ODS;
- Whether the emerging destruction technologies identified in the TEAP's 2010 Progress Report and any other new technologies can be recommended for inclusion on the approved technology list for destruction of ODS;
- How best to deal with the destruction of Banks in low-volume-consuming countries that ensures destruction that optimizes cost benefts and determines how to aggregate small quantities of ODS in these countries to facilitate effective and sound destruction.

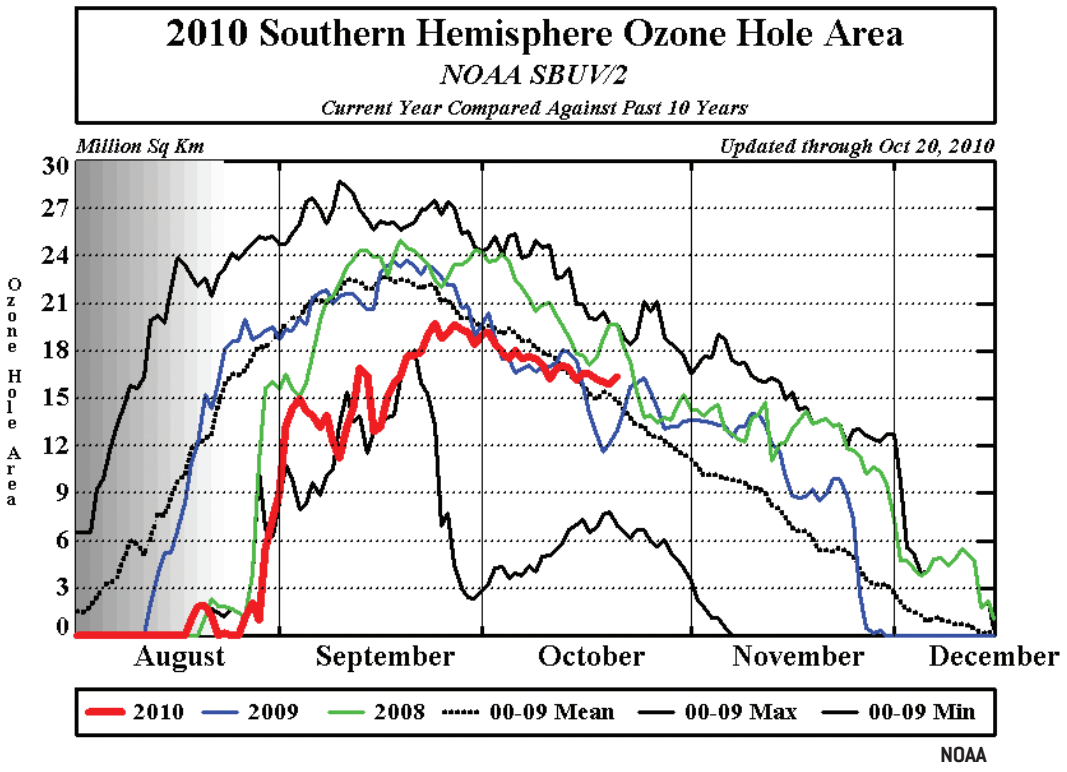
POTENTIAL FOR TRANSITIONING PHASED-OUT ODS STILL IN SERVICE TO LOW-GWP ALTERNATIVES

Article 5 countries completed the phase-out of CFCs and other original ODS on December 31, 2009, and non-Article 5 countries completed their phase-out by 1996. However, despite the phase-out, huge Banks of CFCs, halons and other original ODS are still in use, with recycled materials being used far beyond the phase-out dates. For example, it is estimated that in the US alone there are more than 15,000 chillers still using CFCs as refrigerants. In Article 5 countries that just passed the final phase-out deadline, original ODS also enjoy a wide variety of uses.

To fulfill its commitment not to restore the ozone layer at the expense of global climate, the Montreal Protocol should assess the extent that opportunities exist to transition CFCs and other original ODS to low-GWP alternatives. In order to assess this issue and incorporate it into the comprehensive Banks program that is developed, the Montreal Protocol needs to:

- Request the TEAP to: a) assess the quantities of phased-out ozone depleting substances (CFCs, halons, fire suppressants and solvents) ("Phased-out ODS") that are still in use; b) assess the potential for transitioning the Phased-out ODS to low-GWP alternatives.
- Request the Scientific Assessment Panel (SAP) and the TEAP to: a) evaluate the climate benefits of transitioning these Phased-out ODS to low-GWP alternatives; b) estimate the incremental costs of transitioning Phased-out ODS to low-GWP alternatives; and c) have the TEAP continue to monitor for the availability of low-GWP alternatives so that the HCFC phase-out takes full advantage of anticipated additional low-GWP alternatives as soon as they become commercialized.

The only viable way to raise the funds required to recover and destroy Banks is to get ODS Banks destruction approved for crediting in mandatory carbon markets.



PROPOSALS AND NEED FOR AN HFC AMENDMENT

An amendment to phase out HFCs under the Montreal Protocol remains by far the most significant, immediate, cost-effective and rational prospect available to the nations of the world for combating climate change. With the potential to avoid 88 to 140 Gts CO_2e emissions by 2050[28] at a cost of approximately 5-11 billion euros,[29] there simply is no other near-term strategy for mitigation that could be implemented by Parties to achieve a comparable level of GHG mitigation. As members of the community of nations, it is critical that Parties reach agreement on initiating a phase-out of HFCs.

Research in 2009 estimated that HFC emissions will reach between 5.5-8.8 Gts CO_2e by 2050.[30] These projections used similar modeling to the Intergovernmental Panel on Climate Change (IPCC) emission scenarios, with growth of HFC use based on gross domestic product (GDP) and population trajectories. However, this research presents a clearer picture of increased HFC use by incorporating recent information on replacement patterns of HCFCs by HFCs and consumption growth in developing countries. Recent research also supports these figures with global HFC consumption expected to reach over 3Gts CO_2e by 2030.[31]

The Velders analysis also indicated that global HFC emissions will significantly exceed previous estimates after 2025, with developing country emissions as much as 800% greater than developed countries emissions by 2050. Global HFC emissions in 2050 are equivalent to 9–19% (CO_2e basis) of projected global CO_2 emissions in business-as-usual scenarios and contribute a radiative forcing equivalent to 6–13 years of CO_2 emissions near 2050.

This percentage increases to 28–45% compared with projected CO_2 emissions in a 450-ppm CO_2 stabilization scenario. Consequently, if left unchecked HFC use will prove fatal to domestic and international efforts to arrest and reverse global climate change by negating anticipated reductions in CO_2 and other GHG emissions.

The need for urgent action to curtail HFC emissions is critical, particularly in Article 5 countries where soaring demand for refrigeration and air-conditioning is triggering a corresponding rise in consumption of HFCs. As HCFCs are progressively phased out in developing countries, HFCs are set to become the dominant substitutes, and are estimated to replace over 75% of historic HCFC consumption unless the Montreal Protocol acts to transition into low-GWP alternatives. Setting a clear schedule to transition directly from HFCs to low-GWP alternatives now will ensure that these nations do not invest in an HFC cul-de-sac, requiring far more costly and difficult mitigation efforts by donor nations in the future.

In October 2010 a preliminary study analyzing HFC abatement options was released. It revealed that low-GWP alternatives are available within all key sectors currently using either HCFCs or HFCs.[32] Furthermore the study found that conversion to low-GWP alternatives would in many cases have a negative lifecycle cost due to improved energy efficiency and lower refrigerant costs. The study concludes that "ambitious controls of HFCs can be carried out at negative or low positive costs". It also warns that failure to restrict use of HFCs right now will have long term effects due to ongoing equipment servicing requirements, estimating that servicing demand will reach almost 50% of future HFC consumption in 2020 and 2030.[33]

As in 2009, two HFC Amendment proposals were submitted in 2010 by the Federated States of Micronesia (FSM), and by North America (Canada, Mexico and the USA). The proposals differ slightly in their timelines for phasing-down HFCs, with the FSM schedule moving more aggressively to start, but both achieve essentially the same level and quantity of emissions reductions by 2050 (see graph). Both HFC proposals also call for a baseline that combines HCFCs and HFCs in recognition of their similar and largely interchangeable nature, and as a means of allowing Parties more flexibility in meeting reduction levels.

Despite strong support for immediate action on the part of many nations, initial objections by some Parties regarding the legality of action on HFCs by the Montreal Protocol, lack of information on alternatives, and questions about costs largely delayed or prevented substantive discussion about the Amendment in 2009.

During the 2010 OEWG meeting, and following progress toward agreement on the terms of reference for the HCFC phase-out and the TEAP's presentation of a report on the availability of alternatives, a contact group was convened to discuss the Amendment. Although inconclusive, Parties are moving closer to action on HFCs, as recently evidenced by the Philippines announcing its formal endorsement of the FSM proposal in September.

With the increasing availability of low-GWP alternatives, and indeed the current feasibility of converting entire sectors (e.g., foams, mobile air conditioning, domestic refrigeration) to not-in-kind or non-HFC compounds and technologies, there are no longer any technical reasons for Parties to delay action to phase-out HFCs. Similarly as every nation is a member of the Montreal Protocol, and given that production and use of HFCs is not regulated under the UNFCCC or any other international accord, there is no conflict or negative consequence arising from the Montreal Protocol taking action on HFCs. On the contrary, the unquestionable and enormous contribution that an HFC phase-out would make toward arresting global warming has become generally accepted within the UNFCCC.

RECOMMENDATION

Parties should give full support to advancing and adopting an HFC Amendment.

DECISION PROPOSAL ON HFC-23 DESTRUCTION

HFC-23 EMISSIONS ARISING FROM THE PRODUCTION OF HCFC-22

As a byproduct of HCFC-22 production, HFC-23 is one of the most potent GHGs ever produced. It has a 100-year GWP of 11,700[34] and can persist in the atmosphere for up to 270 years.[35] HFC-23 has very limited uses and is generally considered a waste gas. Generally within CDM plants, for every 35 tonnes of HCFC-22 that is produced, around one tonne of HFC-23 is generated;[36] production of HFC-23 at non-CDM plants is typically much lower with product to waste ratios approaching 100:1 (as opposed to 35:1 at CDM plants).[37]

Currently, HCFC-22 production is growing in developing countries by about 25% per year, and while the Montreal Protocol plans to phase out emissive (non-feedstock) uses by 2030, use for feedstock production is not controlled and is likely to continue to grow in developing countries.[38] In 2005, global use of HCFC-22 for emissive purposes was estimated to be 420,000 million metric tonnes (Mts), compared to 264,000 Mts for feedstock use. By 2015 this situation is expected to reverse, with 495,000 Mts of HCFC-22 produced for feedstock and 245,000 Mts for emissive uses.[39]

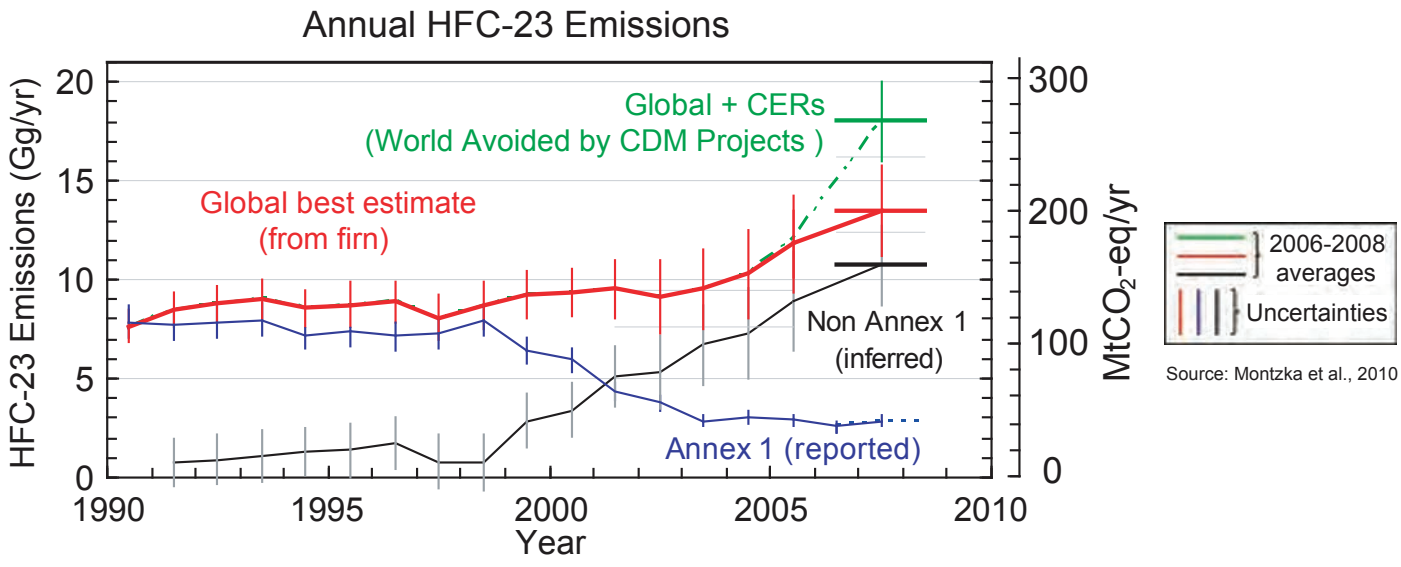
HFC-23 emissions have significantly increased over the last two decades, and although recent studies reveal a decline in emissions since 2006 associated with Clean Development Mechanism (CDM) destruction projects, over half of the developing world's HFC-23 production is still emitted directly into the atmosphere. A 2009 study in *Geophysical Research Letters* noted that substantial amounts of HCFC-22 were produced but not covered by existing CDM projects (around 57% in 2007).[40] In examining atmospheric concentrations of HFC-23, the study estimated average global HFC-23 emissions for 2006-2008 at about 200 Mts CO_2e per year, or about 50% higher than levels derived for the 1990s.[41] This increase is attributed to developing country HCFC-22 production (89% of which is estimated to originate from China), with emissions in 2007 estimated to be 160 Mts CO_2e.[42]

Draft decision XXII/M *Phase-out of HFC-23 as a by-product of HCFC-22 production*, submitted by Mexico, Canada and the U.S.A., seeks to address these emissions by requesting the Protocol's Executive Committee to formulate guidelines for implementing destruction projects at HCFC-22 facilities currently not covered by the CDM.

The draft decision requests the Executive Committee: to update information on HCFC-22 production facilities in A5 nations; to develop estimates of incremental costs associated with the collecti on and destruction of HFC-23; to formulate guidelines for funding projects to collect and destroy HFC-23 by-product; and, to facilitate the development and implementation of HFC-23 destruction projects. In addition the Decision requests the TEAP in consultation with the SAP to conduct a study of the potential costs and environmental benefits of HFC-23 by-product control measures.

CURRENT APPROACH TO HFC-23 EMISSIONS

For HCFC-22 production facilities covered by the CDM, Certificates of Emissions Reductions (CERs) are issued for the destruction of the HFC-23 to prevent its atmospheric release, with one CER being generated for each CO_2e tonne destroyed. This means that 11,700 (the GWP of HFC-23 according to the UNFCCC) CERs are issued for the abatement of just one tonne of HFC-23. While HFC-23 destruction projects represent just 2.5% of the CDM projects that presently generated CERs, they account for



Source: Montzka et al., 2010

218 million (49%) of the 440 million CERs issued to date.[43]

CDM HFC-23 destruction projects have provided a financial windfall, profiting mostly Chinese and Indian chemical companies and European financial backers, as well as the Chinese Government who taxes the sale of HFC credits at a rate of 65%. Of 19 registered HFC-23 destruction projects, 11 are in China, five in India, and one each in Argentina, Mexico and the Republic of Korea. These projects cover less than half the estimated HFC-23 production in developing countries.[44]

It is estimated that the destruction of HFC-23 can be carried out at a cost of just €0.17 per C O_2e tonne.[45] However, when this destruction is commoditized and sold as CERs on the EU Emissions Trading Scheme (ETS) market, it can easily command as much as €12, some 70 times more than it costs to destroy the gas. As such, HFC-23 destruction credits are so valuable that they may exceed the value of the primary product (HCFC-22).[46]

The impact of this disparity between the cost of HFC-23 destruction and the value of the resulting CERs has been widely publicized and was fully documented in a request to revise the methodology submitted to the CDM's Executive Board in March 2010. This submission provided overwhelming evidence that HCFC-22 manufacturers are gaming the CDM system and undermining carbon markets by producing excess HFC-23 just so they can be paid to destroy it.[47]

In response, the Executive Board and its Methodologies Panel are carrying out a review of the HFC-23 CDM methodology, and all requests for HFC-23 CERs have been suspended pending review since August 2010.[48] As of late October 2010, requests for issuance of more than 18 million HFC-23 CERs were being withheld pending review.[49]

Despite attempts to solve this problem at the UN level, it is widely expected that the European Commission will shortly propose a ban on all HFC-23 credits in Phase III of the ETS (2013 - 2020), thus eliminating the largest market for HFC-23 credits.[50]

With the future of current HFC-23 CDM projects so uncertain, and little interest in the development of new CDM HFC-23 projects and renewal of existing projects, it is clear that current and ongoing HFC-23 emissions will only be addressed through a mechanism outside the CDM. The HFC-23 Draft Decision offers a timely and cost-effective way to address these substantial GHG emissions. HFC-23 is a by-product of an ODS substance being phased out and under direct regulatory control of the Montreal Protocol, and therefore its responsibility.

RECOMMENDATION

Parties should adopt the HFC-23 Decision Proposal without delay.



Vertical fluorocarbon painting system. HCFC-22 feedstock use for teflon and other polymer production has increased dramatically.

THE MONTREAL PROTOCOL SHOULD REGULATE HCFC FEEDSTOCK

In addition to their use as refrigerants and foam blowing agents, HCFCs are used for feedstock applications in the manufacture of chemicals, pharmaceuticals and agricultural products.[51] Feedstock uses are not controlled by the Montreal Protocol as it is understood that they are non-emissive or 'intermediate' applications.

As noted previously, in contrast to future reductions in HCFC production and consumption for emissive uses, global HCFC feedstock production is likely to continue growing. During 2010 demand for HCFC-22 for feedstock use is expected to reach 380,000 tonnes and overtake production for emissive uses. This production is expected to rise to 495,000 tonnes by 2015.[52]

Historically non-Article 5 countries have dominated HCFC feedstock production, however HCFC-22 feedstock production in Article 5 countries has grown steadily. In 2007, the TEAP documented signs that production could be shifting from developed to developing countries, possibly due to lower production costs.[53]

The challenge for Article 5 countries to meet HCFC accelerated phase-out targets is immense. Demand for HCFCs for emissive uses in developing countries has risen steadily at about 15% per annum since 2002, barring a dip in 2008 following the economic recession.[54] As the supply of HCFCs onto refrigerant markets is reduced there is a real risk that HCFCs produced for non-emissive uses will be diverted onto black markets. The MLF has recognized this threat to the HCFC phase-out and in 2008 recommended measures such as HCFC tracking be established.

As an interim step it would be worth considering adding HCFCs produced for feedstock into HCFC licensing systems. Licensing systems are well established in Article 2 countries and many Article 5 countries have either established or are in the process of creating HCFC systems to enable compliance with the accelerated HCFC phase-out. Licensing HCFC feedstock producers would allow Parties to monitor trade in feedstock HCFCs as the HCFC phase-out in Article 5 countries gets underway.

To give a more comprehensive view of HCFC feedstock production and trade it would be advisable to include this category in current Article Seven trade data reported by Parties to the Ozone Secretariat.

RECOMMENDATIONS

In order to avoid the potential wide scale diversion of HCFCs produced for feedstock onto illegal markets, Parties to the Montreal Protocol should take the following cost-effective and simple measures:

- Report all HCFC feedstock production and trade to the Ozone Secretariat in the same way that emissive use of HCFCs is currently reported;
- Cover trade in HCFCs for intermediate/feedstock use under existing ODS licensing systems;
- Fully finance an Accelerated HCFC-22 phase-out under the Montreal Protocol, with feedstock use only by Essential Use Exemption (EUE).

Another option is for the Montreal Protocol to achieve a faster phase-out of HCFC-22 in both feedstock and non-feedstock applications. This would be accomplished in three simultaneous parts:

First, Parties to the Montreal Protocol should remove the blanket feedstock exemptions for HCFC-22 and make such feedstock uses a part of the EUE process. To date, such EUEs are only granted after complete phase-out of an ODS (CFCs, Halons, and methyl chloroform).

In cases where there is a need for HCFC-22 use as feedstock prior to the phase-out, Parties will have to request EUEs for specific annual quantities of HCFC-22. The TEAP will evaluate EUE nominations based on agreed criteria, with authorization decided on a case-by-case basis by the MOP for a specified use, quantity, substance, conditions and exemption interval.

Second, non-A5 Parties should finance the phase out of HCFC-22 (including feedstocks, wherever feasible) faster than currently mandated among Article 5 Parties to the Montreal Protocol. The existing schedule can be retained, but with supplemental replenishments to the MLF to increase funding levels to allow both an early HCFC phase-out and to leapfrog past high-GWP HFCs.

Third, Parties should request the TEAP to identify substitutes and alternatives as follows:

- Options for producing HCFC-22 without HFC-23 emissions
  - New chemical processes without HFC-23 by-product
  - Optimized production with near-zero HFC-23 emissions
- Options for producing the same products without use of HCFC-22 feedstock
- Options for "not-in-kind" alternatives to products now made with HCFC-22
  - Discontinue products made from HCFC-22 feedstock, particularly when those products have health and environment issues such as toxic emissions, atmospheric fate, bio-accumulation, etc.
- Phase-out HCFC-22 production (thus eliminating HFC-23 byproduct) for all uses controlled by the Montreal Protocol (underway).

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NASA









MADHAVA SARMA

Madhava Sarma was an ever-present source of support and inspiration for staff at EIA and Parties to the Montreal Protocol. Having served as Executive Secretary for a decade and then a further decade as a consultant, Sarma never lost his hope and optimism for what the Montreal Protocol could achieve. He always had time to offer advice and encouragment and recognised the valuable contributions of environmental NGOs. A wonderful human in every respect, Sarma embodied that altogether rare and most precious mixture of knowledge, respect, integrity and modesty. He remains a shining example to us all and will be missed.



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