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**Concept Paper:  
GEF-5 Ozone, Climate, and Chemicals Program**

## Table of Contents

I. Program and Sector Background.....	1
Managing ODS Banks .....	1
Inefficiency of Old ODS Appliances .....	1
Disposal of Old ODS Appliances .....	2
Energy Efficiency Standards for New ODS Appliances.....	2
Barriers to Replacement and Recycling of Inefficient Appliances.....	2
Management of POPs and Mercury .....	3
Technology Transfer.....	3
Consistency with Montreal Protocol.....	3
Consistency with Stockholm Convention .....	4
Consistency with National Strategies and GEF Operational Programs .....	4
II. Program Description.....	5
Appliance Replacement and Recycling .....	5
Potential Program Partners .....	6
Energy Efficiency Standards.....	6
Low-GWP Manufacturing .....	6
Management/ Disposal of ODS and POPs.....	6
III. Program Benefits .....	6
Greenhouse Gas Benefits.....	6
Ozone Benefits.....	7
Energy Benefits.....	7
PCB Benefits.....	7
Mercury Benefits .....	7
GEF Benefits.....	8
IV. Financial Mechanisms.....	8
GEF Funds .....	8
Bilateral Funds.....	8
Utility Funding.....	8
Retailer/ Manufacturer Contribution.....	8
Recycling Company Contribution .....	8
Carbon Credits on a Voluntary Carbon Market .....	9
MLF Funds under Montreal Protocol .....	9
CDM under Kyoto Protocol.....	9

1. This ozone, climate, and chemicals program paper is conceived under the GEF-5 Chemicals Strategy and incorporates the Climate Change Mitigation Strategy. The implementation of this program will bring about energy efficiency and reductions of ODS, GHGs, POPs, and mercury through the replacement and proper disposal of refrigeration and air-conditioning equipment, and ODS and POPs stockpiles. It includes a number of potential funding sources.

## **I. Program and Sector Background**

### **Managing ODS Banks**

2. The Montreal Protocol has achieved remarkable success in reducing the production and consumption of ozone-depleting substances (ODS). This success can be attributed to the strict mandates put in place for the phaseout of ODS production and consumption. Today however, a large amount of ODS still remains in equipment and products such as refrigerators and air conditioners (as refrigerant and foam blowing agent), fire protection systems and fire extinguishers, as well as in stockpiles held by countries and industrial and commercial users. Together these sources are referred to as “ODS banks”.

3. The Montreal Protocol, through counting imports and production of ODS, identifies a 100% reduction in consumption. This created an anomaly in regard to Banks of ODS which have been technically phased out, but remain a threat to the Ozone Layer and the Climate. Neither the Montreal Protocol nor the United Nations Framework Convention on Climate Change (UNFCCC) currently has a mechanism to deal with these banks.

4. ODS banks, if not recovered and properly treated, will release ODS into the atmosphere over time through slow leakage, catastrophic leaks, and unintentional (or intentional) venting. The Scientific Assessment of Ozone Depletion of 2006 found that ODS banks are a significant issue for the ozone layer, and constitute the largest ODS emissions to the atmosphere. The 2005 [Intergovernmental Panel on Climate Change](#)/ Technology and Economic Assessment Panel (IPCC/TEAP) Special Report on Ozone and Climate estimated worldwide banks at over 20 billion tons CO<sub>2</sub>eq in 2002. This would decrease to about 18 billion tons CO<sub>2</sub>eq in 2015 under a business as usual scenario. This means that approximately 2 billion tons CO<sub>2</sub>eq will be emitted between 2002 and 2015 if no action is taken. The entire amount of banks will be eventually emitted to the atmosphere, unless preventive measures are taken.

### **Inefficiency of Old ODS Appliances**

5. Refrigerators are one of the most energy consuming appliances in the household. Old units may consume significantly more electricity than new, energy efficient units. Retiring old refrigerators and replacing them with new efficient models can have a significant impact on energy efficiency and energy demand. Increased energy demand results in a need for additional generation and transmission. In countries where energy generation is typically fossil fuel based, a reduction in energy generation reducing generation will result in reduced emissions of

greenhouse gasses. Demand Side Management (DSM) projects such as a refrigerator retirement and recycling program are currently being demonstrated in countries like Brazil and can help utilities to moderate demand, increase access to electricity, and reduce the need for new generation infrastructure. Furthermore, switching to an energy efficient refrigerator can reduce individual household energy bills and save money, which is important especially in low-income developing countries and countries with economies in transition (CEITs) households. Similarly, updating chiller systems can have significant energy and cost savings.

### **Disposal of Old ODS Appliances**

6. Once removed from the grid it is critical that refrigeration and air-conditioning equipment is properly managed. Household refrigeration and air-conditioning systems contain a number of substances that need to be properly handled at end-of-life, including Chlorofluorocarbon (CFC) and hydrochlorofluorocarbons (HCFC) refrigerants and foam blowing agents, polychlorinated biphenyl (PCB) capacitors, mercury switches, and used oil which can be contaminated with PCBs or refrigerant. CFCs and HCFCs, used as refrigerants and foam blowing agents, are not only ozone-depleting substances, but they are also very potent greenhouse gasses (GHGs). The CFCs and HCFCs most commonly used as refrigerants and foam blowing agents in old household appliances have global warming potentials (GWPs) of 10,900 and 725<sup>1</sup> respectively. Mercury and PCBs contained in appliances can have serious environmental and human health effects if emitted. Therefore, proper management of these substances is critical. Lastly, recycling the durable components of the appliance (i.e. metal plastic, and glass) can save energy and reduce emissions of GHGs by reducing the need to generate virgin materials. Recycling metal from old appliances can be a revenue stream because scrap metal often yields a high market value.

### **Energy Efficiency Standards for New ODS Appliances**

7. Energy efficiency standards for the production and import of new ODS appliances ensure that new appliances added to the grid will meet the countries' energy efficiency and demand management goals. If energy efficiency standards are not already in place, countries should develop them under this program. This will result in long term, sustainable results.

### **Barriers to Replacement and Recycling of Inefficient Appliances**

8. Despite the clear benefit to appliance owners of opting for energy efficient appliances through significant savings in energy costs, replacement is not taking place because of financial, technology, and information barriers. In an environment of competing investment opportunities and resource constraints, appliance replacement which requires upfront capital expenditures is not a priority of building and home owners. The main barriers include access to capital and lack of awareness of the potential savings that could be rendered by the new technology.

9. Despite opportunities for developing sustainable recycling industries and the environmental benefits from managing ODS containing equipment, proper disposal of ODS

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<sup>1</sup> GWP calculations based on the 100-year direct GWP provided in the Intergovernmental Panel on Climate Change Fourth Assessment Report (2007). GWP values are relative to CO<sub>2</sub> which has a GWP of 1.

appliances and ODS is not being achieved. The Montreal Protocol has production and consumption requirements but does not extend to disposal. Proper disposal is possibly not taking place due to lack of access to capital and resources, lack of regulatory requirements or lack of awareness of regulatory requirements, lack of technology and infrastructure, and lack of information.

### **Management of POPs and Mercury**

10. Persistent organic pollutants (POPs) and mercury pose a serious threat to both local and global human health and the environment. Because of these risks the Stockholm Convention became effective in May 2004 to eliminate or restrict the production, use, and release of POPs. Mercury is also recognized as a global pollutant requiring coordinated international effort, which is why governments have agreed to launch negotiations on a global, legally binding mercury instrument. This program will address sources of POPs and mercury and use best available techniques and environmental practices (BAT/ BEP) to manage and potentially destroy sources and stockpiles.

### **Technology Transfer**

11. In the 2010 “*GEF Impact Evaluation of the Phaseout of Ozone-Depleting Substances in Countries with Economies in Transition*” the first recommendation to the GEF Council is to “invest in destruction facilities to provide government and private sector with appropriate options for safe and cost-effective disposal of obsolete ODS.” The report goes on to say that “destruction of ODS would create synergies with ongoing efforts to safely destroy POPs stockpiles.” New destruction technologies are coming to market that use non-combustion techniques for both the destruction of POPs and ODS. These new technologies may have an advantage in developing and CEIT countries because they do not require a large facility; rather the size of the facility can be customized to the country’s needs and they can destroy both ODS and POPs. Furthermore this type of technology may be more energy efficient than standard combustion incineration technology, and outputs from the chemical destruction process may be sold if the country has a market for the output chemicals. Non-combustion technologies often convert chemicals back to their constituent/component chemicals.

### **Consistency with Montreal Protocol**

12. Recognizing the importance of managing ODS banks in an environmentally sound manner; the Parties to the Montreal Protocol took Decision XX/7. This decision outlined preliminary actions to better understand and address the issue of ODS banks, including: requesting the Executive Committee of the Multilateral Fund to consider commencing pilot projects related to the destruction of ODS; requesting the TEAP to conduct an analysis of destroying ODS banks; requesting the Ozone Secretariat to consult with experts from other funding mechanisms on possible funding opportunities for managing and destroying ODS banks.

13. A demonstration project has been established for a Multilateral Fund Grant for Mexico for the disposal of unwanted ODS from appliances. The implementing agency for the Mexico

demonstration project is United Nations Industrial Development Organization (UNIDO) with assistance from the Government of France. The demonstration project will cover ODS already collected as well as additional ODS collected under the accelerated replacement program for old refrigerators with new energy efficient models led by the Government of Mexico through the Fund for Energy savings (FIDE).

14. A demonstration project has also been established for a Multilateral Fund (MLF) Grant for Brazil for the early retirement of refrigerators and ODS destruction. It is estimated that there are 11 million CFC containing refrigerators in Brazil with the equivalent to 33 million tones of CO<sub>2</sub> contained in them. The implementing agency for the Brazil refrigerator collection and disposal project is United Nations Development Program (UNDP) with assistance from Government of Germany. The Brazil project is driven by the Energy Efficiency Law which facilitates the donation of new energy efficient refrigerators to low income families in exchange for their old, inefficient units. Electric utilities initially established the program because of the significant energy efficiency gains achieved from installing new, efficient refrigerators in low income households. The program also benefits low income households by lowering their utility bills because a high proportion of their electric bill results from operating the refrigerator. The government is looking to scale this project up from 150,000 refrigerators per year to one million units per year. In order to accomplish this they are looking into additional funding sources such as tax incentives for manufactures to participate, bilateral donor assistance, and carbon finance.

### **Consistency with Stockholm Convention**

15. The Stockholm Convention aims to ensure the sound management of stockpiles and wastes (including equipment) that contain POPs. This program is consistent with the country obligations under the convention for POPs management both from disposed appliances and from other sources. Best management practices will be employed including collection, storage, and destruction.

16. The Stockholm Convention is also looking for coordination with the Montreal Protocol, specifically coordination with decision XX/7 of the Montreal Protocol on Environmentally Sound Management of Banks of Ozone-Depleting Substances. Decision SC-5/27 of the Stockholm Convention “Enhancing cooperation and coordination among the Basel, Rotterdam and Stockholm conventions” reads, in section I paragraph 8 on joint activities:

- (a)“8. Invites the Meeting of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer, considering its decision XX/7, to participate in and support partnership activities with the Basel, Rotterdam and Stockholm conventions and other multilateral environment agreements as outlined in the joint activities set out in annex I to the present decision;”

### **Consistency with National Strategies and GEF Operational Programs**

17. This Program will be developed within the context of the national strategies to meet country obligations under the Montreal Protocol and Stockholm Convention for management of ODS and POPs and country energy efficiency objectives.

18. Country will be Party to the Montreal Protocol (MP), Kyoto Protocol (KP), and Stockholm Convention (SC) to be eligible for financial and technical assistance from the MLF, the GEF, and the CDM for projects that meet the objectives of these international conventions. The Program meets the objective of the KP by encouraging energy savings which in turn reduces emissions of GHGs. It also fits into the objective of the GEF by transforming the marketplace and introducing the concept of life-cycle based decision making in the appliance sector. The Project will also meet the objective of the MP by facilitating the replacement of old ODS-based appliances and ensuring proper ODS recovery and disposal using best environmental practices. The Project meets the objective of the SC by ensuring the proper management of POPs using BAT/ BEP. The program will contribute to the country government's ongoing efforts to meet its obligations under the MP, KP, and SC.

19. This Program will utilize GEF resources in line with the GEF-5 Strategy for Chemicals including POPs, mercury, and ODS and also the GEF strategy for Climate Change Mitigation (CCM). GEF assistance will accelerate the market conversion for energy efficient appliances by addressing and removing barriers through the development, marketing, and implementation of an incentive-based appliance replacement and recycling program. The Program meets the objective of the GEF in that it will replace older appliances with newer ones that are more energy efficient and utilize refrigerants that are lower in GWP and have lower or zero ozone depleting potential; support the development and transformation of the market for energy and facilitate a low-carbon growth path; increase market penetration of energy-efficient appliances in the residential and commercial building markets; and support market transformation to accelerate GHG emissions reduction by making use of carbon financing.

## II. Program Description

20. The following components should be incorporated into an ozone, climate, and chemicals program.

### **Appliance Replacement and Recycling**

21. The program will promote the retirement and replacement of old, ODS containing appliances with energy efficient units. Old equipment will be collected and disposed of at an appointed appliance recycling facility. Appliances will be disposed of using best environmental practices available. This project may provide capital for new advanced appliance recycling technology. Recycling facilities will have the ability to demanufacture equipment, separate the different components, and send the components to appropriate facilities for further processing. For example, insulation foam from appliances should be recovered using automated technology or manual methods at the recycling facility then the foam can be sent for destruction using recommended technologies under the Montreal Protocol, or the blowing agent may be concentrated from the foam and sent for destruction or reclamation. Recovered and destroyed ODS refrigerant and foam may be eligible for credits on the voluntary carbon market. Additional ODS from stockpiles can also be destroyed and paid for by the revenue stream generated from selling of the recyclable material and offset by the potential credits generated.

## **Potential Program Partners**

22. This program may partner with electric utility companies to initiate the retirement and replacement of old, ODS containing appliances with energy efficient units. Utilities should have a strong interest in participating in energy efficiency programs such as this. Incentives could be used to encourage the replacement of ODS equipment. Additional program partners should include retailers and manufacturers of ODS equipment. Retailers and manufactures could offer rebates on the sale of new efficient equipment and collect and provide assistance in proper disposal of old units. Retailers and manufactures could also pay into a fund to finance the proper disposal of old equipment. If retailers collect old appliances when delivering new units they should ensure that the collected appliances are delivered to the dedicated appliance recycling facility. Appropriate legislation, policies, and incentives will have to be developed.

## **Energy Efficiency Standards**

23. Country specific energy efficiency standards and labeling for appliances ensure that appliances manufactured or imported meet certain criteria. Standards also ensure market transition and penetration of more efficient units. Countries without energy efficiency standards may wish to enact them as part of this program resulting in long term sustainable benefits. GEF Funding in the CCM focal area can be used by countries along with their funding from the MLF to develop these standards.

## **Low-GWP Manufacturing**

24. Additional long term sustainable benefits can be achieved by shifting appliance manufactures away from high-GWP refrigerants and foam blowing agents to low-GWP alternatives. Countries with manufacturing practices that use high-GWP refrigerants and foam blowing agents should consider switching to more environmentally friendly alternatives as part of this program. Funding from the MLF and the GEF can be combined.

## **Management/ Disposal of ODS and POPs**

25. The options for proper management of ODS once recovered from equipment include reclamation (i.e. recycling) if the country has servicing needs for old CFC based equipment or destruction using technologies recommended by the Montreal Protocol's Technology and Economic Assessment Panel (TEAP). Options for the proper management of POPs including containment, storage, and destruction using some potential technologies have been identified by the GEF Scientific and Technical Advisory Panel (STAP). Technologies that can destroy both ODS and POPs at the same facility may be available.

## **III. Program Benefits**

### **Greenhouse Gas Benefits**



26. ODSs contained in appliances as refrigerant and foam blowing agents are potent GHGs. Although new appliances are no longer manufactured with CFCs, due to the long lifetimes of equipment it is likely that the majority of old refrigerators being disposed of through this program will contain approximately 0.22 kg CFC-12 refrigerant and 0.45 kg of CFC-11 foam blowing agent. CFC-12 has a GWP of 10,900 and CFC-11 has a GWP of 4,750. The climate benefit of proper recovery of refrigerant and foam blowing agent from a single refrigerator will result in emission reductions of 4.50 MTCO<sub>2</sub>eq.

### **Ozone Benefits**

27. The CFCs contained in appliances as refrigerant and foam blowing agents are potent ozone depleting substances. Proper recovery of the 1.5 lbs (1 lb from foam and 0.5 lbs from refrigerant) of CFCs contained the typical refrigerator will help to protect the earth's ozone layer. Additionally the development of a sustainable recycling enterprise can pay for the disposal of ODS contained in stockpiles. Since these stockpiles are finite the initial costs of destroying them will be offset by the long-term sustainability of a recycling enterprise.

### **Energy Benefits**

28. New refrigerators are significantly more energy efficient than old units. Replacing a 20 year old refrigerator with a new energy efficient model can save a household 500<sup>2</sup> kWh or more per year which is equivalent to .35 MTCO<sub>2</sub>eq<sup>3</sup>. If you assume that the old refrigerator would have stayed on the grid for an additional 8 years without the GEF funded replacement and recycling program that's 2.8 MTCO<sub>2</sub>eq saved per appliance.

### **PCB Benefits**

29. Appliances manufactured prior to 1979 (this date may differ by country) contained capacitors with a small amount of PCBs. These pre 1979 capacitor should be properly managed. Although there is only a small amount of PCBs in each appliances, when you aggregate the effect of releasing PCBs from the millions of appliances disposed annually the emissions are very significant. Any capacitor in an appliance manufactured prior to 1980 should be treated using BAT/ BEP for PCB management. Proper management of other PCB sources including stockpiles will result in significant local and global environmental benefits. An inventory of sources will be required to estimate benefits.

### **Mercury Benefits**

30. Mercury switches can be found in ODS containing appliances, and are most commonly used in chest type freezers. Mercury switches should be removed from appliances and treated through safe collection and handling practices. Mercury is extremely toxic and even small amounts released can result in serious health and environmental effects. Other mercury sources

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<sup>2</sup> U.S. Energy Star Program

<sup>3</sup> Calculated using U.S. EPA's GHG calculator: [www.epa.gov/cleanenergy/energy-resources/calculator.html](http://www.epa.gov/cleanenergy/energy-resources/calculator.html)

will be assessed and addressed through this program resulting in significant local and global environmental benefits.

### **GEF Benefits**

31. The GEF will be able to, within existing mandates, tackle a problem that no other mechanism or process has been able to address, resulting in global ozone, climate, and chemicals benefits.

## **IV. Financial Mechanisms**

32. Project financing could come from the following sources:

### **GEF Funds**

33. Because this project has both climate and chemicals benefits GEF funding could come from both pools. Additionally, the GEF Private Sector Strategy funds can be applied if there is significant involvement from industry and a development bank is involved.

### **Bilateral Funds**

34. Developed countries should have an interest in supporting this program.

### **Utility Funding**

35. Implementing this energy efficient appliance replacement program will result in significant energy demand savings for the utility. Therefore, the utility could cover a portion of the new appliance cost while the home owner covers the remainder. Both the utility and home owner will experience cost savings from the switch to a new energy efficient unit. The utility will realize a reduction in energy demand while the home owner will save money on their monthly utility bill. Thus the investment by both the utility and homeowner will be repaid over time.

### **Retailer/ Manufacturer Contribution**

36. Retailers and manufacturers should have a responsibility to ensure that the products they manufacture and sell are properly managed at their end-of-life. Therefore, they could pay into a fund based on a percentage of their market share to contribute to recycling costs. Additionally, retailers and manufacturers could offer customers rebates on new energy efficient appliances.

### **Recycling Company Contribution**

37. The recycling facility will benefit from this program because they will gain new appliance recycling equipment using best available technology. Although this is a onetime investment in technology by the GEF project, the technology will last several years and the benefit to the recycling company will continue long term. The recycling company will also

realize revenues from recycling appliances; specifically they will make a profit on selling the metal collected from appliances. Revenues from scrap metal can be significant. Therefore the recycling company could contribute funds to the project through the costs associated with transporting appliances, labor costs associated with dismantling appliances and management of the waste streams, and tracking and reporting measures.

### **Carbon Credits on a Voluntary Carbon Market**

38. Several voluntary carbon markets now have protocols for gaining carbon credit for destruction of ODS. Credits are available on these markets because of the high global warming potentials of ODS. Preventing the release of these substances through destruction by technologies recommended under the Montreal Protocol results in significant climate benefits. Different markets have different requirements for destruction and verification and may also apply different discount rates. A carbon market that only allows destruction credits from ODS that have been globally phased out of production will be used for this program. A market that allows credit for destruction of substances that have not been phased out of production worldwide may create a perverse incentive for new production of chemicals to be destroyed for credit. This is important because it is nearly impossible to tell the difference between ODS that has been recovered from equipment and virgin ODS. Credits for ODS destruction projects will require methodologies for project development, validation, and verification.

### **MLF Funds under Montreal Protocol**

39. The Multilateral Fund (MLF) is the financial mechanism for the Montreal Protocol. The fund supports transition out of ODS for Article 5 countries but does not extend to countries with economies in transition. The MLF supports collection and disposal of ODS equipment, thus MLF funding may be available for this program depending on the host country.

### **CDM under Kyoto Protocol<sup>4</sup>**

40. In 1997, the international community adopted the Kyoto Protocol (KP), which requires developed countries to reduce emissions by an average of 5.2% between 2008 and 2012, compared to 1990 baseline. The KP has a number of flexibility mechanisms, including the Clean Development Mechanism (CDM), which enables developed countries to reduce the costs of compliance through the purchase of emissions reductions from projects in developing countries, provided that the emission reductions are real, measurable and long term, and that CDM projects meet sustainable development objectives in those countries. Because of the energy efficiency component of this program it may be eligible for CDM credits. The program builds the capacity of appliance owners and allows utility companies to realize energy efficiency transformation in the appliance sector. The status of CDM post 2012 is unknown.

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<sup>4</sup> Note that if CDM funding is applied GEF Climate Mitigation funding may not be available.