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EXECUTIVE COMMITTEE OF
THE MULTILATERAL FUND FOR THE
IMPLEMENTATION OF THE MONTREAL PROTOCOL
Sixty-second Meeting
Montreal, 29 November - 3 December 2010

PROJECT PROPOSAL: GHANA

This document consists of the comments and recommendations of the Fund Secretariat on the following project proposal:

Destruction

- Pilot demonstration project on ODS waste management and disposal UNDP

PROJECT DESCRIPTION

Introduction

1. UNDP, on behalf of the Government of Ghana, submitted to the 62nd Meeting a proposal for a pilot demonstration project on ozone depleting substances (ODS) waste management and disposal at a cost of US $377,677 as originally submitted. This project is submitted in line with decision 58/19 and will address the destruction of 14.8 mt of waste ODS in the country. The Government of Ghana is requesting the approval of this project at the 62nd Meeting.

2. At the 57th meeting, the Executive Committee provided funds for UNDP to prepare a pilot ODS demonstration project for Ghana. At that Meeting the decision was taken to look at pilot ODS disposal projects that would respond to decision XX/7 of the Twentieth Meeting of the Parties, which provided that pilot projects could cover the collection, transportation, storage and destruction of ODS, with a focus on assembled stocks with high net GWP, and in a representative sample of regionally diverse Article 5 countries. Members also stressed that ODS disposal demonstration projects should be feasible, and should include methods of leveraging co-funding. Ghana was one of the countries selected based on this criteria.

Background

3. At the 58th Meeting of the Executive Committee, criteria and guidelines for the selection of ODS disposal projects were discussed, and led to decision 58/19. This decision established the basis for the review and approval of ODS disposal demonstration projects. The review carried out by the Secretariat was based on the principles established through this decision. The Secretariat would like to emphasise that it applied sub-paragraph (a)(ii)a. of the decision, which specified that no funding would be available for the collection of ODS. The definition for the collection of ODS was included in an annex to the report of the 58th Meeting, called “definitions of activities included in the interim guidelines for the funding of demonstration projects for the disposal of ODS”. This pilot project for Ghana will cover already collected ODS as well as additional amounts to be collected under the project for the promotion of energy efficient refrigerators through Market Transformation to be funded by the Global Environment Facility (GEF).

4. This pilot project seeks to develop an efficient and cost-effective logistic framework for the transport, storage and destruction of ODS in Ghana. As indicated above, this pilot project is closely integrated with the proposed GEF funded Energy Efficiency (EE) project where End-of-Life (EOL) and early retired energy inefficient refrigerators will be collected and dismantled in regional depots for ODS recovery. Incentives schemes (rebate, turn in and carbon credits) are developed under the GEF EE project to incentivize consumers to purchase EE refrigerators/freezers. These efforts would be complemented by the existing terminal phase-out management plan (TPMP) and HCFC phase-out management plan (HPMP) related recovery operations for the servicing of existing refrigeration equipment, which also will generate volume of ODS waste that can no longer be re-utilized. A detailed project proposal is attached as Annex I to this document.

Project description

5. This pilot project will initially address the disposal of the 1.8 tonnes of CFC-12 that has already been collected and ready for destruction. At the same time, it will put in place measures to support the sustainability of the project looking at available ODS waste that will be collected through a national collection system to be put in place under the EE programme currently for approval by the GEF. The national government has also provided policy support to the programme by putting in place national regulation that will discourage the export of ODS waste and promote the importation of ODS waste from neighbouring Economic Community of West African States (ECOWAS) countries as a regional import model. The ODS destruction demonstration project is envisaged to be implemented in three years.

6. The project proposes to destroy ODS locally by establishing a local destruction facility using plasma arc technology. A plasma arc destruction system will be set up to decompose the ODS into calcium fluoride and calcium chloride in line with the accepted destruction rate of 99.99 per cent Destruction and Removal Efficiency (DRE). The test performance of the plasma arc machine has shown a decomposition rate of 99.99 with no dioxin emissions detected.

Estimation of the ODS to be disposed

7. The sources of ODS for destruction are from existing stocks, refrigerant recovery programme and import from ECOWAS countries. Currently Ghana has 1.8 metric tons (mt) CFC-12 in storage for disposal. The refrigerant to be recovered through the yet to be approved GEF EE programme is estimated as an additional 5.8 mt of CFC-12 from disposed refrigerators based on 50,000 units to be collected over 3 years using an 80 per cent recovery rate. The estimated quantities are shown in Table 1.

Table 1: Estimated quantities of ODS-waste that will be used in the project

	Number	**Tonnes**
In storage (already collected)		1.8
From GEF EE Programme	50,000	5.8
From ongoing and future R&R schemes	10,345	1.2
From ECOWAS imports of ODS-Waste		6.0
		14.8

Financial management of the project

8. The proposal envisages that funding from the Multilateral Fund will cover costs for the implementation and operation of the pilot project for 3 years. It also foresees that carbon credits could be used to scale up the project, depending on the results of the pilot activity. At least 30,000 units would need to be turned in annually from the GEF EE programme for the recovery of 2.4 tonnes of CFC-12 to give a verified emission reduction (VER) of 22,500 t-CO_2-equivalent and to fetch at least US $3/t$CO_2$-equivalent VER. This means that the plasma machine operates at 1 shift for 8 hours in order to destroy this amount. If it operates at two shifts a day it will destroy 4.8 tonnes of CFC-12 which would give a profit of US $32,280. This assumes that the GEF project will be fully operational at the same time as funding from the Multilateral Fund will be made available.

9. At the end of the three years of GEF and Multilateral Fund assistance and, on the basis of the above, the project will convert other ODS recovered into carbon credits thereby making the facility sustainable. Ghana intends to turn in 1 million old refrigerators over 10 years. This would translate into 100,000 refrigerators per year, but to take a more conservative estimate of 30,000 refrigerators per annum equals 2.4 tonnes or more of CFC-12 per year, which could represent the potential amount in the best case scenario available for destruction in the future.

Monitoring and verification of the destruction

10. In order to ensure that all the ODS are properly monitored and accounted for, the process will be closely monitored and data will be recorded in both dismantling centres and the destruction centre. A stringent monitoring and verification plan will be put in place to avoid double counting and other errors. Traceability and chain of custody will be developed to ensure transparent and accountable monitoring. For instance, data collected in dismantling centres could include serial number of the disposed equipment and indication of the quantities collected in each piece of equipment to link with the identification number of the cylinders to be used. In the destruction centre, the ID of cylinders will be

recorded to match with the information at the collection stage. The transparent monitoring procedure will allow the independent external verification of the destroyed ODS for certification of carbon credits.

Cost of the project

11. The total cost of the project has been estimated at US $377,677 as originally submitted shown in the table below.

Table 2: Proposed cost of the project

1. Capital equipment cost		Unit	184,677
1.1	Plasma Arc machine	1	100,000
1.2	Equipment transport from Japan to Ghana	1	5,820
1.3	Installation and training cost	1	14,333
1.4	Accessories: transformer, stabiliser, UPS battery	1	49,524
1.5	ODS Identifiers and cylinders	1	15,000
2. Transport cost			29,000
2.1	Transportation within Ghana, 7 mt	@ 2 US$/kg	14,000
2.2	Transportation from ECOWAS region. 5 mt	@ 3 US$/kg	15,000
3. Operational cost			164,000
3.1	Labours cost	2 persons for 3 yrs	81,000
3.2	Water, electricity and space rental	USD 3,000 for 3 yrs	9,000
3.3	Chemicals and spareparts for maintenance	USD 3,000 for 3 yrs	9,000
3.4	Technical assistance cost	Consultant	60,000
3.5	Workshops	1	5,000
Total			377,677

SECRETARIAT'S COMMENTS AND RECOMMENDATION

COMMENTS

12. The Secretariat advised UNDP that the consideration of this project at the 62nd Meeting is contingent upon the final approval of the GEF EE project that is currently awaiting the endorsement of the GEF Chief Executive Officer (CEO), as this GEF project provides the structure for the fundamental collection system for other ODS waste to be collected. If the collection system is not in place, then the pilot project cannot be implemented. In response UNDP indicated that there was certainty in the approval of the GEF project, and that this endorsement should be received before the 62nd Meeting to be held in Montreal.

13. The Secretariat provided UNDP with a number of comments and observations on the proposal as reviewed following the criteria set out in decision 58/19.

14. Concerns on the availability of sufficient ODS-waste to make the programme successful and sustainable were raised. Out of the 14.8 mt that the pilot is targeting for destruction, only 1.8 mt is currently available and collected in the country. The Secretariat indicated that while the project preparation approval was based on the collected 1.8 mt of ODS waste already collected, a system needs to be in place where a steady supply of waste can be generated for the programme to be profitable. UNDP responded that the Government of Ghana through the Ministry of the Environment has already informally contacted some countries in the region where ODS wastes are available and has stressed that the setting up of an ODS-waste centre in Accra is a priority for the Government. The Government has also written to

these countries and this will allow Ghana to fully collect information on ODS banks in these countries. This was the basis for indicating that 6.0 mt would be available from these countries. Transportation costs to Accra will be partially covered by this pilot project.

15. UNDP is also certain that due to the Government's commitment to have this pilot project in place, the GEF EE project will be implemented soon after approval, therefore additional waste streams will be there. UNDP also mentioned that, for the first six months to one year, the activities related to the facility will be to set it up, and it assumes that by the second year more ODS waste will be available in addition to the 1.8 mt.

16. The Secretariat was also concerned about establishing a new institution in the country for destruction, and how it will be financially viable and sustainable. It resulted in a proposed funding that included costs to cover the operation and management of the plasma facility which, from the view of the Secretariat, should be taken over either by the government or a private entity. After further discussion, UNDP revised the proposal to include specifically that the operations of the facility will be clearly sub-contracted and linked to one importer who has agreed to operate it. This will be a performance-based sub-contract, the details of which are attached as part of the submission.

17. In addition to the above, UNDP advised that consultations with local stakeholders have indicated that the local private sector does not as yet have the capacity to take on such a pioneering project which will involve some degree of risks. Therefore this pilot project offers an opportunity to identify and overcome the technical, financial and regulatory risks for the mainstreaming of viable ODS destruction in Ghana and across the ECOWAS regions.

18. The proposal indicated that it explored other options for destruction in Ghana. As there are no cement-kiln facilities, this was not a viable option. UNDP also considered the possibility of export for destruction. After calculating costs, this was found to be a little cheaper than the currently proposed facility (i.e. US $21/kg of ODS destroyed). However, this approach was not endorsed by the government as it wanted to pioneer ODS destruction in the region, and requested the agency to continue with the proposal using the plasma arc technology.

19. Issues about the plasma arc technology were also raised in relation to the assumption that it will operate at a high level of efficiency, and that any decrease in the performance level could impact on the amount to be destroyed. UNDP contacted the supplier who confirmed that to date 20 units have been in operation in Japan clocking up to 4,000 hours of operation per year per machine. UNDP is therefore certain that, with this technical confirmation, the machine could operate a maximum of 20 hours per day and could destroy 10 kg of CFC-12 per batch with half an hour rest between plasma arc ignition. UNDP also indicated that the supplier will provide an initial comprehensive installation training in Accra and will continue to provide online technical support.

20. With regard to the issue of profitability and sustainability of the project, UNDP emphasized that the funding requested is necessary only to kick start the project and thereafter carbon credits will be used to sustain it. UNDP provided a sensitivity analysis to compare annual refrigerator units (20,000 to 90,000 @ 80 grams/unit), annual ODS CFC-12 volume (1.6 to 7.2 t) and VER prices (US $2 to US $5 per VER). This showed that the destruction of ODS will be profitable in terms of VERs and could be used to sustain the project in future, depending on the collection of waste from the GEF project. UNDP also mentioned that Ghana's experience with the economic, social and environmental benefits of phasing out of energy inefficient incandescent lamps makes the government's commitment to phase out energy inefficient appliances stronger. According to UNDP, this national commitment will be the driving force behind this project.

21. The Secretariat and UNDP also discussed the funding requested for the project, and indicated that while the capital costs could be recommended, it requested UNDP to adjust the costs allocated for

management and operation of the facility to no more than two years. This would provide support for the start-up of the project. UNDP agreed, however it maintained that the current project will be implemented for three years, but costs for the facility will be adjusted to two years only. This adjustment resulted in a cost of US $22.4/kg of ODS destroyed. This cost is higher than that allowed under decision 58/19 of a maximum of US $13.2/kg, but since Ghana is a low-volume-consuming (LVC) country, it is not covered by this specific component of the decision. The Secretariat further noted that since Ghana is an LVC country, the approval of this project might be considered as part of the funding window for ODS activities for LVC countries in line with decision 60/5(i) and could be used as a reference in the discussion on agenda item 10, "Overview of issues identified during project review".

22. The final cost of the project was agreed to be US $331,677 plus support costs. This is summarized in the table below:

Table 3: Agreed costs of the project

	Budget	**Unit**	**US$**
	A. Capital cost		
Equipment	Plasma Arc	1	100,000
	Transport Japan-Ghana	1	5,820
	Installation Cost	1	14,333
	Transformer	1	3,175
	Stabilizer	1	25,397
	UPS Battery Backup	1	20,952
	Identifier, Cylinders, etc	1	15,000
	Total capital cost		**184,677**
Transport	**B. Transport cost**		
	Transportation from Dism and R&R Centres	@ 2 US$/kg	14,000
	Transportation from ECOWAS region	@ 3 US$/kg	15,000
	Total transport cost		**29,000**
	C. Sub-contract cost to operate the facility		
Personnel	Two technicians working two 8-hour shifts	2 persons	54,000
Facility	Space, security, electricity, water, AC in existing facility		6,000
	Operating Costs Machine (chemicals, maintenance)		6,000
	Total sub-contract cost		**66,000**
UNDP Support	Part-time National Consultant	1 person	23,500
	International Consultant	1 visit/yr	23,500
	Awareness Raising Workshop	1	5,000
	Total cost		**52,000**
	Grand Total		**331,677**
	Project Cost-Effectiveness (USD/kg CFC-12)		**22.4**

RECOMMENDATION

23. The Executive Committee might wish to consider:

(a) Noting with appreciation the submission of the Government of Ghana of a pilot ODS waste management and disposal project to destroy a total of 14.8 metric tons of ODS waste;

(b) Noting further that this project is a pilot demonstration project for an LVC and therefore could be considered as part of the funding window for ODS activities in low-volume-consuming (LVC) countries in light of decision XXI/2 of the Twenty-first Meeting of the Parties and on the basis of the policy discussion under agenda item "Overview of issues identified during project review";

(c) Approving in principle the implementation of a pilot project for ODS waste management and destruction in Ghana at the amount of US $331,677 plus support costs of US$ 24,876 for UNDP subject to the receipt of the GEF Chief Executive Officer's endorsement of the GEF energy efficiency project; and

(d) Approving the amount of US $331,677 at this meeting and noting that this approval is on the understanding that no further funds will be available for Ghana for any ODS disposal projects in future.

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Project Document

Government of Ghana

United Nations Development Programme

Funded by the Multilateral Fund (MLF) for the Implementation of the Montreal Protocol

Pilot Demonstration Project on ODS-Waste Management and Disposal

25 October 2010

COUNTRY:	**Ghana**
IMPLEMENTING AGENCY:	**UNDP**
PROJECT TITLE:	**Pilot Demonstration Project on ODS-Waste Management and Disposal**

PROJECT IN CURRENT BUSINESS PLAN:	**Yes**
SECTOR:	**ODS-Waste**
Sub-Sector:	**Refrigeration Servicing Sector**
PROJECT IMPACT:	**14.8 Metric Tons of CFC-12**
PROJECT DURATION:	**36 months**
PROJECT COSTS:	**US$ 331,677**
LOCAL OWNERSHIP:	**100 %**
EXPORT COMPONENT:	**0 %**
REQUESTED MLF GRANT:	**US$ 331,677**
IMPLEMENTING AGENCY SUPPORT COST:	**US$ 24,876 (7.5 %)**
TOTAL COST OF PROJECT TO MLF:	**US$ 356,553**
COST-EFFECTIVENESS:	**US$ 22.4/kg ODS (metric)**
PROJECT MONITORING MILESTONES:	**Included**
NATIONAL COORDINATING AGENCY:	**Ghana-EPA**

Brief Description.

UNDP Ghana in collaboration with the Environment Protection Agency (EPA), Energy Commission of Ghana and the Center for Rural and Industrial Research (CRIR) has developed on an overarching strategy to provide climate and ozone benefits through the Integrated Plan for Energy Efficiency, Climate Mitigation and ODS Reductions for the Refrigeration Sector as shown in Figure 1. This integrated plan brings about the convergence of 3 synergistic interventions to combine and sequence multilateral funding for: (i) the phasing out of HCFC based appliances (MLF); (ii) the promotion of energy efficient refrigerators through Market Transformation (GEF) and (iii) the complimentary pilot project for the recovery and destruction of ODS (MLF). The ultimate objective of this plan is to bring economic, social and environmental benefits to the people in Ghana through the scaling up of energy efficient appliances with low global warming potential (GWP) and zero ozone depleting potential (ODP) for the mainstreaming of ozone and climate benefits into the national development plan.

This 'learning by doing' pilot seeks to demonstrate on how the technical, financial, regulatory and institutional barriers and risks could be overcome to set up an ODS destruction facility. This project will demonstrate the safe and efficient destruction of ODS refrigerants recovered from old stock (1.8 t) and subsequent early retired or end of life (EOL) refrigerators/freezers, air-conditioners and from the servicing sectors using a commercially available plasma arc destruction unit that meet will TEAP ODS destruction criteria. The destruction facility will be operated by a sub-contractor of an existing refrigerant importer or distributor through a performance based subcontract. To ensure project sustainability, ODS waste in refillable cylinders from neighboring countries will also be imported to Ghana for destruction as a regional import model and opportunity to monetize the ODS destroyed as carbon credit for the voluntary market will be explored so that alternative sources of funds may be tapped into once this MLF-funded project will be completed. In addition to the carbon market, other financial modalities will also be explored: bilateral grants and auction from the European Union Allowance (EUA).

1. INTRODUCTION AND BACKGROUND.

The Government of Ghana is requesting funding for the starting up of a pilot project to evaluate and demonstrate on the safe disposal and destruction of ODS. The project complies with the criteria established by Decision 58/19 and it will focus on specific aspects not previously addressed by pilot projects in the West African sub region. This 'learning by doing' project will be the first of its kind in the West African region, and will demonstrate how the technical, financial, regulatory and institutional barriers can be overcome for the mainstreaming of ODS destruction project. This project will generate valuable information about possible models to establish a long term self sustained system to collect ODS from the banks and destroy them. Furthermore, this information could also be helpful to other ECOWAS countries interested to undertake similar approaches to manage their ODS banks. As there is no ODS destruction technologies or equipment in West Africa, there is great potential to collect, recover and destroy ODS in banks and in old inventory stocks which justifies the investment.

The case of Ghana has the following unique features:

- This project seeks to demonstrate the viability or otherwise of an in-country small scale destruction option, noting that this is part of a larger strategic approach by UNDP to demonstrate a range of options in the projects it is currently assembling for a range of country specific situations. The way this tends to be evolving is that i) Brazil, a large A5 country will demonstrate the option of destruction in utilizing existing national Hazardous Waste management infrastructure, specifically high temperature incineration that is readily available; ii) Cuba, an A5 country with a End of Life ODS capture rate now will demonstrate (hopefully) the option of using cement kilns, iii) Columbia would demonstrate an export option perhaps in association with Persistent Organic Pollutants (POP) stockpile management. Ghana as a matter of policy wants to manage its own waste legacies to the maximum degree practical and that they see this as a way to ensure that in the longer term the potential returns from a carbon finance mechanism will be retained by the developing country rather than be partially exported.

- Ghana is a developing country with no ODS destruction facilities in place. This is the situation of many countries in the region, which makes this pilot attractive as the information generated and lessons learnt could be shared with other countries with comparable characteristics. A plasma arc technology for the destruction of CFC-12 and HCFC-22 will be analyzed. The destruction of CFC-11 contained in foam will not form part of this pilot-project in order to stay within a reasonable budget.

- To complement local ODS supply and to ensure project sustainability, ODS waste from Ghana will not be exported but ODS waste from the neighbouring ECOWAs countries will be imported. The risks and barriers (economic, legal, Basel and Rotterdam conventions stipulations, etc.) for such interventions will be identified and means for mitigation will be formulated.

- This pilot project seeks to develop an efficient and cost effective logistic framework for the transport, storage and destruction of ODS in Ghana. As such, this pilot project is closely integrated with the GEF funded Energy Efficiency (EE) project where End-of-Life (EOL) and early retired energy inefficient refrigerators will be collected and dismantled in regional depots for ODS recovery. Incentives schemes (rebate, turn in and carbon credits) are developed under the GEF EE project to incentivize consumers to purchase EE refrigerators/freezers. These efforts would be complemented by existing TPMP and HPMP related recovery operations for the servicing of existing refrigeration equipment, which also will generate volume of ODS waste that can no longer be re-utilized.

- The destruction facility will be operated by a sub-contractor through a performance based bidding process. The sub-contractor will be guided by a comprehensive operation and a stringent monitoring plan to be supervised by national consultant with training provided by technology provider.

- The opportunity to leverage market based finance mechanisms and other innovative modalities (bilateral grants and EUA auctions) will be explored for the conversion of environmental services of avoided ODS emissions into carbon assets. Means for mitigating the technical, regulatory and financial risks will be discussed.

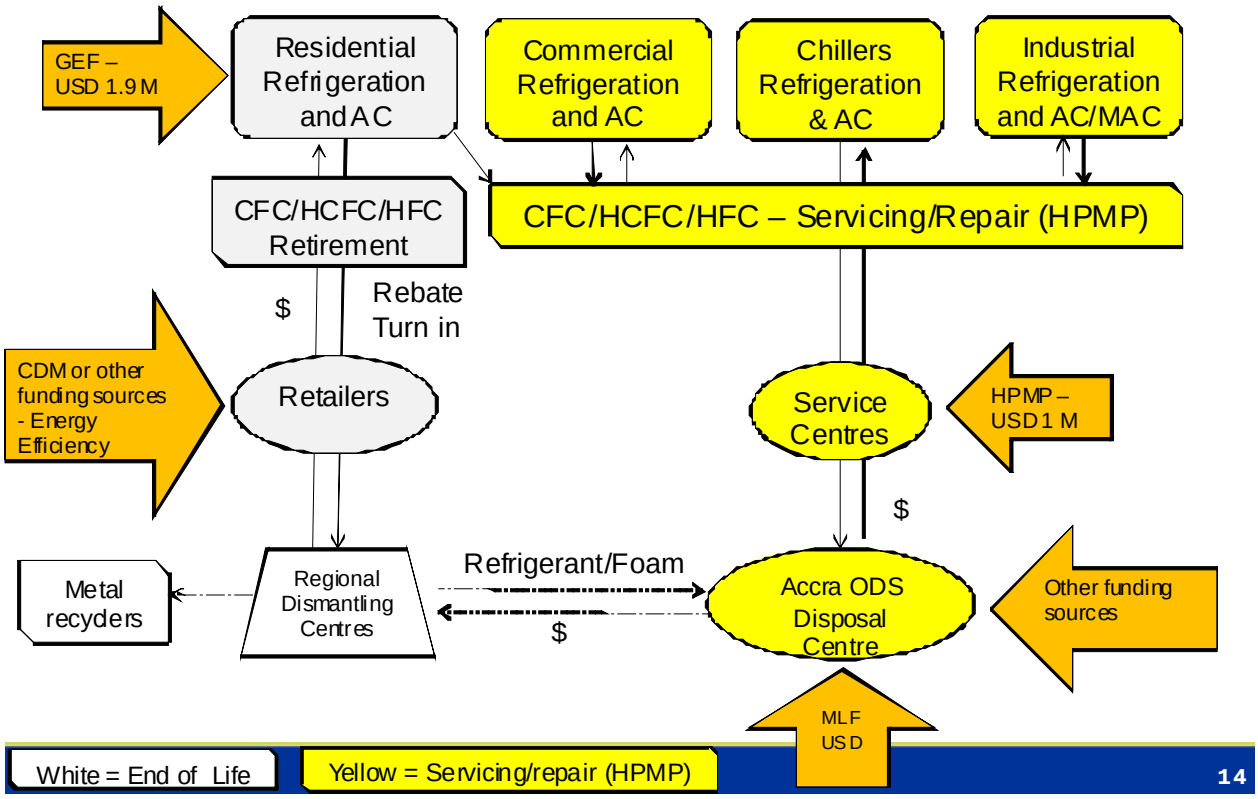
2. OVER-ARCHING STRATEGY AND PROJECT OBJECTIVES

The Multilateral Fund for the Implementation of the Montreal Protocol (MLF) has been set up to support developing countries in their efforts to phase out the use of Ozone Depleting Substances well before the protocol deadline of 2010 and in this way to maximize the related environmental benefits for the global community. The Fund has for over fifteen years supported ODS phase out projects. By and large this support has been restricted to the so-called Annex-A substances from which CFCs constitute the main group. A Terminal Phase out Management Plan (TPMP) is ongoing in Ghana to address the CFC phase-out. The conversion of HCFCs, which have Ozone Depleting Potentials (ODPs) of only 5-10% of those of CFCs, is now recently being supported as well and the formulation of an HCFC Phase out Management Plan (HPMP) are being developed.

UNDP Ghana in collaboration with EPA, Energy Commission and the Center for Rural Industrial Research (CRIR) has developed on an overarching strategy to provide climate and ozone benefits through the Integrated Plan for Energy Efficiency, Climate Mitigation and ODS Reductions for the Refrigeration Sector as shown in Figure 1. This integrated plan brings about the convergence of 3 synergistic interventions: (i) the phasing out of HCFC based appliances (MLF); (ii) the promotion of energy efficient refrigerators through Market Transformation (GEF) and (iii) the complimentary pilot project for the recovery and destruction of ODS (MLF). Opportunities to convert the environmental services into carbon credits and assets offered by these programs will be explored. The ultimate objective of this plan is to bring economic, social and environmental benefits to the people in Ghana through the scaling up of energy efficient appliances with low global warming potential.

While it would be cost-effective to address only one refrigeration subsector (e.g. residential fridges) in larger countries, due to the large volume of equipment units, this would not be the case for a smaller country like Ghana, which is an example of a Low-Volume Consuming Country (LVC) as it only uses HCFCs in the refrigeration servicing sector. The proposed Integrated Plan would therefore address all subsectors (residential, commercial, industrial refrigeration, air-conditioner [AC], mobile air-conditioner [MAC], chillers) and all types of refrigerants (CFCs, HCFCs and HFCs).

Figure 1: Integrated Plan for Energy Efficiency, Climate Mitigation and ODS Destruction Management



The TPMP and HPMP phase out project only target the servicing sector where functioning refrigerators are being repaired. Whilst the TPMP and HPMP programs are targeted at the accelerated phase out of ODS in the servicing sector, the ODS destruction project seeks to reduce potential ODS and carbon emissions from the ODS bank. This proposed ODS destruction pilot project with a MLF funding seeks to address both early refrigerator retirement program through rebate and turn in as well as End-of-Life program when old refrigerator reach the end of their life and are beyond repair. It is evident that some of the actions undertaken would address the objectives of both the Montreal Protocol and the Kyoto Protocol.

Figure 1 provides an overview of how the proposed Integrated Plan would work. Boxes in white represent the GEF-funded End-of-Life "Market Transformation for Energy Efficiency" programme, while the yellow boxes represent ODS management projects for the servicing sector financed by the MLF. Through the End-of-Life Scheme, equipment would be collected by trained retailers or NARWAO workshops owners scattered across Ghana.

The refrigerators would be stockpiled and then transported to Regional Dismantling and Recovery Centres. The recovered refrigerants would be stored safely in refillable cylinders and the foam packaged as bale would be sent to a central ODS Disposal Centre to be located in Accra. As proposed in this project, all the unusable ODS refrigerants would be destroyed locally using the proven plasma arc technology.)In transition to a full destruction scheme, the opportunity for initial ODS recycling or reuse will be explored. TPMP and HPMP activities would involve servicing operations on existing equipment, which would be supported by the MLF.

The brown arrows relate to the expected influx of funding from the GEF/MLF and other potential sources. Downward arrows in the diagram represent the process by which refrigeration equipment/refrigerant is delivered to the Regional Dismantling and Recovery Centre. Upward arrows represent resources required to make the programmes operational and MLF and GEF funding (or funding from other grants) is needed to help developing countries and enterprises (especially Small-Medium Sized Enterprises) cover the necessary upfront investments. Without these funds they would not be able to cover these costs. As such GEF and MLF funding would play a critical role in kick-starting the above-mentioned scheme in Ghana during the first couple of years.

GEF-funds would initiate the Early Retirement as well as End-of-Life scheme for the domestic refrigeration sector. The MLF's previous TPMP efforts and upcoming HPMP funds would help establish a refrigerant recovery scheme and collection centre, while the MLF's ODS waste pilot project would help fund ODS destruction operations, or transhipment ODS waste for destruction abroad. The legislative framework required to help sustain the operations will be established.

Once the model has been tested and proven, it is anticipated that other sources of finance, including carbon finance, would generate the necessary funding that would allow the cycle to continue and to become self-sustainable. The ODS Destruction Centre would contribute to the provision of reliable information regarding the reclaimed/disposed ODS amounts, which in turn would facilitate obtaining approval for these alternative funding sources.

3. JUSTIFICATION FOR THE ODS-DISPOSAL PILOT PROJECT

The Executive Committee, at its 58th Meeting, has approved a set of interim guidelines for the funding of demonstration projects for the disposal of ODS in accordance with paragraph 2 of decision XX/7 of the Meeting of the Parties. The followings described in detail how the project complies with the Decision 58/19:

3.1. Updated and more detailed information for all issues required to obtain project preparation funding.

i. An indication of the category or categories of activities for the disposal of ODS (collection, transport, storage, destruction), which will be included in the project proposal.

The collection of refrigeration equipment will be carried out under the GEF funded Energy Efficiency project (Figure 1) where a grant of USD 1.72 million will be used to establish Regional Dismantling Centres for the recovery of CFC-12 and HCFC-22 refrigerants from early retired or End-of-Life (EOL) domestic refrigerators/freezers. The GEF EE project is in an advance stage of responding to comments received from GEF CEO and it is anticipated that approval will be granted before the 62th Ex-Comm meeting.

Other ODS streams will be coming from the commercial sector covered under the MLF-funded TPMP and HPMP programs for the phase out of CFCs and HCFCs. Hence, this pilot project would thus not deal with the collection/dismantling of refrigeration equipment, but solely with the transport, storage and destruction of the unusable ODS that would be resulting from the GEF, TPMP and HPMP programmes.

ii. An indication whether disposal programmes for chemicals related to other multilateral environmental agreements are presently ongoing in the country or planned for the near future, and whether synergies would be possible.

National Programme on Energy Efficiency:

A GEF-funded Full-Size Project on energy-efficiency in Ghana to be implemented by UNDP would allow Ghana to introduce minimum energy performance standards (MEPS) for refrigerators in addition to air-conditioners and compact fluorescent lamps which already have MEPS approved in 2005. The banning of used and second hand refrigerators will prevent the importation of obsolete and energy guzzling appliances which place a heavy burden on the already strained national power supply. Much as the Government of Ghana has approved energy labels for air conditioners with a minimum of EER 2.8 for single star air conditioners two years ago, the Parliament of Ghana has in October 2009, approved an act effective within six months, establishing energy Standards and Labels (S&L) for all new refrigerators and freezers imports into the country. This ODS-Waste pilot project will complement the effort to be undertaken by GEF EE project for the scaling up of energy efficiency appliances via market based mechanism to incentivize behavior change.

To reduce energy demand, ozone depletion, and global climate impacts, it is critical that the older and inefficient refrigerators are permanently removed from homes, offices and other locations and properly disposed of so that environmentally-harmful refrigerants and foam blowing agents are captured and recycled or destroyed. Given the large number of refrigerated appliances expected to be taken out of service under the market transformation, the environmental impacts of removing and properly disposing of old appliances can be significant

The GEF project would set up regional equipment-collection and dismantling centers. The MLF-current pilot project on ODS-waste would tie into this effort by assuring transportation of the refillable cylinders to a centralized ODS-waste centre in Accra that would focus on the final disposal of these ODS.

Ghana - Capacity Building for PCB Elimination: Polychlorinated Biphenyls (PCBs) are not regulated in Ghana. PCBs have been found in significant quantities in equipment in the electrical power network in Ghana. Approximately 2 % of the transformer population is filled with pure PCB oils and some 12% are contaminated with PCBs due to maintenance practices. In addition 147 capacitors (7.5 tons) of PCB containing capacitors have been inventoried. The GEF-funded project implemented by UNDP-UNITAR is aimed at strengthening the capacities and capabilities of government officials and stakeholders outside of government to address PCB identification, manage existing sources of PCBs as well as their elimination/destruction. The project develops and describes a strategy, and the required steps, from the current unsustainable management of PCB-containing equipment to sound management and disposal practices. This GEF project will focus on capacity building and PCB destruction in addressing not only Ghana's PCB-related obligations under the Convention, but also related to wider chemicals management issues. The economic and legal feasibility to combine the export of ODS-waste with PCB for destruction overseas will be explored in this MLF-funded pilot proposal. In this regard, it can be anticipated that Ghana will propose a PCB stockpile elimination project for GEF funding and likewise is a participant in the multi-agency Africa Obsolete Pestide Stockpile project, both of which could offer sunergies for the destruction of ODS along with other chlorinated EOL chemicals.

Hazardous Wastes: In response to the global mandate for environmentally sound management of hazardous, solid, radioactive and electronic waste (e-Wastes), Ghana has among other things, embarked on a life cycle approach to address chemicals and other hazardous wastes management in an integrated manner. This involves a broad range stakeholder institutions and organizations including non-governmental organizations. In 1997, a comprehensive National Chemicals Management Profile was prepared by the EPA with the assistance of United National Institute of Training and Research (UNITAR) and the Inter-organization Programme for Sound Management of Chemicals (IOMC). Other programmes, which are being undertaken, include the framework for Integrated Coastal Zone Management.

The issue of waste management has become a subject for research in many stakeholder institutions. The management of plastic waste is receiving attention. Some technologies have been developed to assist recycling of waste. A number of small-scale plastic waste recycling plants have been set up in the Greater Accra Region. There are plans to set up similar ones in other metropolitan, municipal and urban areas of the country. The management of other solid and hazardous waste is also being researched at the Ghana Atomic Energy Commission and the Council for Scientific and Industrial Research (CSIR). Exogenous technologies are also being studied for their appropriate adoption and transfer for local use. This proposal will develop sound management and infrastructure for the safe disposal of metals and scraps from the de-manufacturing processes of retired refrigerators.

iii. An estimate of the amount of each ODS that is meant to be handled within the project.

Information included in following paragraph.

iv. The basis for the estimate of the amount of ODS; this estimate should be based on known existing stocks already collected, or collection efforts already at a very advanced and well-documented stage of being set up.

The project will start by destroying the 1.8 t of CFC-12 that NOU has collected in store. But given that there is only 1.8 t of CFC-12 stock in Ghana (Table 2), one of the risks identified in this project is the sustainable supply of enough ODS for destruction. In order to overcome these uncertainties, steps are being taken to ensure the sustainable supply of ODS for destruction: i) strong political will and buy in to support the program to replace energy inefficient refrigerators (through a GEF funded EE programme); ii) discouragement for the export of ODS and iii) the importation of ODS from neighboring ECOWAS countries as a regional import model. The Minister of Environment of Ghana has issued a letter of intention to safeguard the supply of ODS as detail in Appendix 1. UNDP has already written to all countries of the region to find out how much ODS are stored in cylinders that could be exported to Ghana for destruction. The Basel Convention would not prevent the movement of ODS between countries in the region that have ratified Basel Convention. For shipment of waste ODS to Ghana, the normal Basel documentation including prior consent and proper training of the staff would be required.

The amounts that will be available for destruction is therefore detailed as follows:

Table 1: Estimated quantities of ODS-waste that will be used in the project:

	Nr	Tons
In storage already		1.8
From GEF EE Programme	50,000	5.8
From ongoing and future R&R schemes	10,345	1.2
From ECOWAS imports of ODS-Waste		6.0
		14.8

This amount would be sufficient to operate the proposed machine at full capacity during two 8-hour shifts.

It is important to understand the urgency of the Ghanaian government to execute this ODS destruction project to complement the GEF EE and HPMP project. The government of Ghana has experienced the economic, social and environmental benefits of legislating pragmatic and sound energy demand side management policy (Minimum Energy Performance Standard) for the promotion of energy efficient appliances as a mean to curb national energy demand. The distribution of six million free Compact Fluorescent Lamps (CFL) in exchange for incandescent lamps in 2007 resulted in a saving of 124 MW of power by the end of the first quarter of 2008 and energy cost savings in excess of US$33 million per annum.

Having seen and tested such life saving benefits and success, the Ghanaian government is keen once again to introduce 50,000 'Star rated' energy efficient refrigerators (average savings from 600 to 950 kWh/year per unit) over a period of three years to further reduce national energy demand under the GEF EE project.

Hence there is already in place a strong political will, financial incentives and institutional support to replace 1 million old and energy guzzling refrigerators to provide further savings in power as a follow up to the GEF EE project. Indeed, the daily opportunity cost is too high for any delay in the replacement of the 1 million energy inefficient refrigerators which is draining both personal and national income. To expedite this urgency, a Pubic Notice was advertised in August 2010 in the national daily newspaper (Appendix 2) by Ghana's Energy Commission on '**Energy Efficiency Standards for Refrigerating Appliances and the Prohibition of the Manufacturing, Importation and Sale of Used Refrigerators and Freezers'.** This is enacted under the legislation approved in Nov 2009 (Energy Efficiency Standards and Labeling (Refrigerator, Refrigerator-Freezer and Freezer - Regulations, LI 1958). Incentives will be provided as turn in rebate coupons from the GEF funding as detail in Appendix 3. Financial modalities to sustain the project beyond the pilot phase will be explored (e.g. market based carbon credit from CDM on energy gain and ODS destruction credits, bilateral grant and EUA auctions).

Table 2 shows the phased approach in the GEF-funded rebate programme. A conservative volume of 5.8 t of CFC-12 ODS could be collected from the 50,000 refrigerators to be turned in under the GEF EE project over the first three years. In addition to this however, there will be the amounts of ODS-waste collected from the servicing centers established during the TPMP and those that will be created by the soon-to-be established HPMP. Furthermore, ODS in cylinders from neighboring countries will be imported to Ghana for destruction.

Table 2: Action plan for the GEF/Govt refrigerator turn-in program in Ghana

Year	2011	2012	2013	2014	2015
Program	GEF EE to turn in 50,000 refrigerators over three years with rebate incentive scheme (Manufacturing, importation and sale of used refrigerators/freezers are banned in May 2010)			Ghana National Turn In Program to replace 1 million refrigerators over 10 years (@ 100,000 units/yr)	
Funding sources	Combine and sequence GEF fund for ODS collection and MLF fund for ODS destruction			Ghana government and voluntary carbon finance	
Refrigerators turned in per year	5,000	15,000	30,000	40,000	60,000
CFC-12 recovered (t)*	0.4	1.2	2.4	3.2	4.8
Old CFC-12 Stock (total 1.8 t)	1	0.8	0	0	0

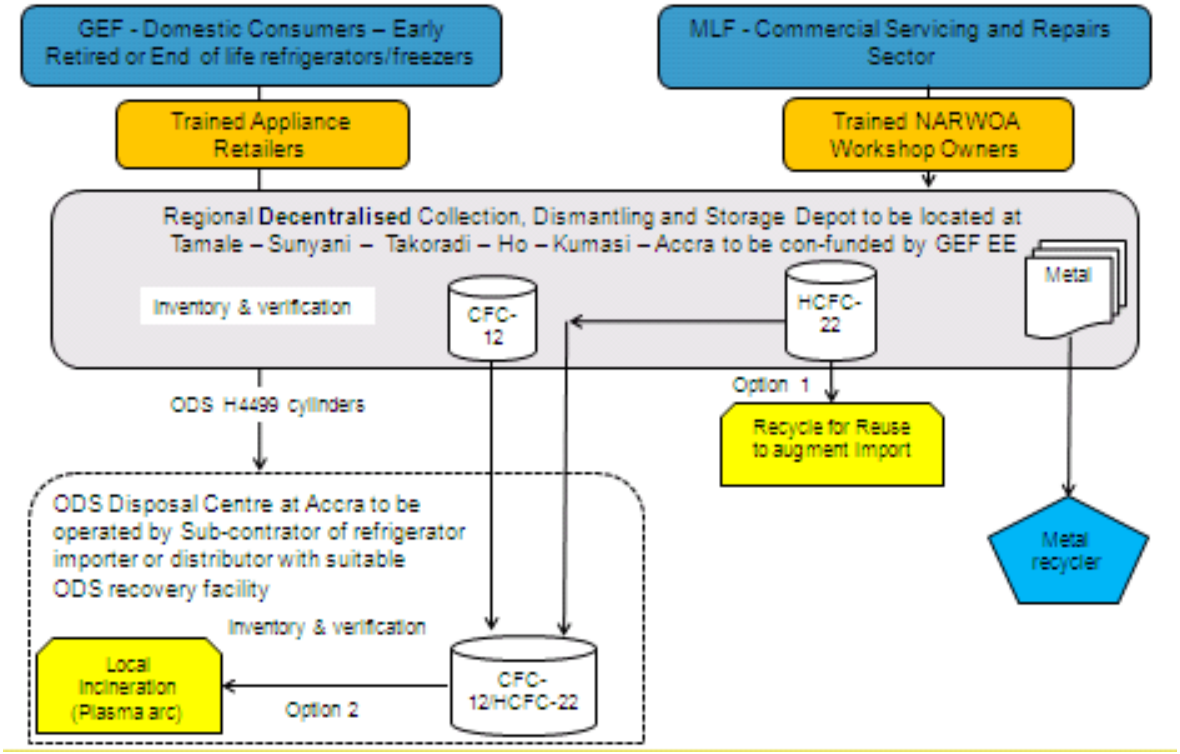
<table>
<tr><td>Other ODS sources</td><td colspan="5">TPMP and HPMP programs (1.2 t) and import from ECOWAS regions (5 t). ODS are discouraged for export (see Letter of Intent by Minister of Environment – Appendix 1).</td></tr>
<tr><td>Total ODS to be destroyed</td><td>1.4</td><td>2</td><td>2.4</td><td>3.2</td><td>4.8</td></tr>
<tr><td rowspan="2">% capacity of 1 plasma machine (2.4 t per shift)</td><td colspan="3">5.8 t (2011 to 2013)</td><td>1 shift</td><td>2 shifts</td></tr>
<tr><td>58%</td><td>83%</td><td>100%</td><td>133%</td><td>200%</td></tr>
<tr><td>Operation of the plasma machine</td><td colspan="3">Sub-contracted out to existing refrigerator importer or distributor on a bidding process (e.g. USD/kg ODS destroyed)</td><td colspan="2" rowspan="2">Sourcing for alternative financial modalities:
i) Market based carbon project development - mitigate technical, financial and regulatory risks
ii) Bilateral grant and
iii) EUA auctions</td></tr>
<tr><td>Action plan</td><td>Bidding process/ Installation</td><td>Operation/ Service</td><td>Evaluation/ Service</td></tr>
<tr><td colspan="6">* 80% recovery of 100 g/unit = 80 g/unit</td></tr>
</table>

v. For collection activities, information regarding existing or near-future, credible collection efforts and programmes that are at an advanced stage of being set up and to which activities under this project would relate.

Relatively large amounts of refrigerant (CFCs, HCFCs, HFCs and HCs) and potentially in the future will be collected from various ongoing GEF EE and HCFC phase out and future programmes (Figure 2). There is a substantial bank of HCFC mixtures (HCFC-22/142b and HCFC-406a) in HCFC based equipment that would not be directly recyclable but warrant destruction. The ODS waste stream will come from the following sources:

- The proposed GEF-funded FSP related to the proposed end-of-life programme in the domestic refrigeration sector;
- Any future expansion to other sectors of this end-of-life programme;
- Continuation of previous Recovery/Recycling schemes (mostly based on CFCs) in refrigeration and MAC and possible cylinders of un-unusable refrigerants that resulted from such past programmes;
- Previous recovery-schemes created during the RMP and TPMP efforts;
- New Refrigerant Recovery schemes that will form part of the upcoming HPMP funded by the MLF; and
- HCFC-related efforts which may indirectly result from the above-mentioned Recovery/Recycling programme

Figure 2: Proposed Collection, Recovery and Destruction of ODS in Ghana



It might also be necessary to elaborate on the commercial relationship between the regional centers, the servicing sector generally and the central destruction facility that is also at least theoretically acting as central clearing house for return of recycled material to the market place.

In view that the success of this ODS pilot is dependent upon the successful collection and recovery of ODS from the GEF EE project and the servicing sector, it is crucial that full commercial relationship, synergy and coordination are forged with GEF EE and HPMP project coordinator to overcome the following challenges in:

(a) **Locating and securing old refrigeration appliances and equipment** – the procedures for the GEF EE turn in program for the collection and recovery of ODS is described in detail in Appendix 3. To ensure better coordination for the collection, recovery and destruction of ODS, the operation of the ODS destruction center will be sub-contracted out to existing importer or distributor with suitable recovery facility as elaborated in more detail in Section 3.2 (iv).

(b) **Enforcement Considerations:** reducing the technical, financial and regulatory risks for the enforcement of ODS collection, recovery and destruction with strong buy in from all stakeholders.

(c) **Coordination of project implementation schedules –** the implementation of the demonstration destruction project substantially depends on the generation of EOL ODS from the GEF project and HPMP so development of the physical destruction capability

has to match this. Likewise, the provision of arrangements for transportation and storage as part of this project needs to be in place as EOL ODS is generated.

Installation and implementation of the ODS destruction machine and facility in Ghana now as opposed to a delay of one or two years would have the following strategic advantages:

- The concerted impact of starting all three converging projects around the same time (GEF EE and MLF's HPMP and ODS) will help to demonstrate the synergistic value of combining and sequencing MEA funding in bringing ozone and climate benefits to the people of Ghana and around the wider ECOWAS regions;
- The start of this ODS destruction project now to complement the GEF EE and HPMP will send a strong signal to the industrial sector that the ODS-waste collection and recovery means "serious business" … a bit like the shot which is fired at the beginning of a running-race will make the athletes start running. Without this clear signal, the risk is high that ODS-waste collection will never get started and ODS leakage may remain high;
- The development of the ODS destruction facility in Accra in step with the GEF project now will help to strengthen the institutional and infrastructure capability for the collection and recovery of ODS;
- To provide sufficient time for the staff to get familiar with the operation and maintenance of the plasma machine;
- The ODS destruction facility could be used as a training center to train technicians locally and for the wider ECOWAS regions on the economic, social and environmental benefits of maximizing ODS recovery and to minimize leakage for demonstrating best practices in a close loop ODS management system and
- The Ghana project provides one of four current projects being undertaken by UNDP for submission at ExCom 61 and ExCom 62. The others (Brazil, Cuba, Columbia) will demonstrate other options tailored to specific country needs and will provide a useful menu of options for replication purposes.

vi. For activities that focus at least partially on CTC or halon, an explanation of how this project might have an important demonstration value;

This project will focus exclusively on the destruction of contaminated CFCs and HCFCs and no CTC or halon will be involved in this pilot project.

3.2. Detailed description of the foreseen management and financial set-up.

Currently abandoned domestic refrigerators/freezers are recycled by individuals in unregulated scrapyard where the foam are either burned openly or thrown in the river and Korle Lagoon and recycled metals sold to scrap dealers. This project will help to reduce health hazards and address the safety issue of the current practices whilst creating employment in the district areas.

This section includes details such as the total cost of the disposal activity including costs not covered by the Multilateral Fund, the sources of funding for covering these costs, description of

the sustainability of the underlying business model, and an identification of time-critical elements of the implementation, which subsequently might be used to monitor progress.

a. Management and financial set-up

i. Collection Centers. As shown in Figure 2, early retired or End-of-Life (EOL) refrigerators will be collected by trained retailers or NARWOA workshop owners in exchange for rebate coupons as an incentive for consumers to replace their old for new energy efficient refrigerators (5 Star) which has low GWP and zero ODS to be co-funded by the GEF EE project. The turn in program is described in Appendix 3 and GEF EE PIF and the price of the rebate coupon is yet to be determined possibly in the range of USD 30 to 50 per unit against a price of USD 130 for new refrigerators. Upon collection, these refrigerators will be transported to the regional dismantling and recovery centres. This decentralized system has the advantage of avoiding the transportation of the old refrigerators with dead weight over a long distance to a central area in Accra.

ii. Dismantling and Recovery Centers. A senior highly trained technician will be hired to manage each center to be supported with two shredders or packers. 50,000 units of refrigerators will be collected and dismantled over the first three years. In addition, four thousands commercial and domestic air conditioners will also be dismantled. Upon receipt, data for each appliance will be recorded, verified and entered into the computer (Figure 3). The ODS from each refrigerator will be recovered by the technician using special equipment according to best practices, labeled and stored in 63.2 kg H4499 refillable cylinders (max ODS weight – 42.5 kg). Each refrigerator will be dismantled by taking out the compressors and stripping out the door and wall.

The foam insulation will be segregated from the metal door and wall. Metal, plastic and wires will be sorted and sold to scrap metal dealers. Given the low volume of foam that is available in Ghana, it may not be viable for an expensive vacuum system to be deployed in order to avoid CFC-11 emissions during the dismantling process. The insulation foam will be stockpiled safely for subsequent destruction.

The dismantling and recovery activities will help to create some local employment.

iii. Transport from Regional Collection-Centers to ODS Disposal Centre in Accra

Once ODS cylinders have been stockpiled, these will be transported to the Disposal centre in Accra and this cost will be covered under the proposed MLF budget. The technician will record and verify all the data. A budget for transport is foreseen in this project (see budget section below). The monitoring and tracking procedures is explained in Section 3.4.

iv. ODS Disposal Centre

The potential options for ODS destruction were identified as i) cement kiln destruction; ii) export to a qualified destruction facilty in an Article 2 country (specifically western Europe), and iii) developing a local facility scaled to meet the country's requirements. Consultation with local

experts has indicated that there is no cement kiln in Ghana and it is not cost effective to modify the only one cement kiln in neighboring Togo for the destruction of ODS waste from Ghana.

The project cost effectiveness for the destruction of ODS in Ghana is estimated at USD $$$22.4 per kg ODS which is slightly higher than the export cost of USD 21.0 per kg ODS (see Table 4, scenario 2). The difference is marginal taking into account the "demonstration" nature of the proposed pilot project and the fact that it is Ghana's explicit wish to develop this capacity locally, as expressed in a letter signed by the Minister of Environment, Science and Technology on 2 September 2010.

Slightly lower destruction costs can be achieved by export to hazardous waste incineration and potentially commercially scaled plasma arc facilities in A2 countries in Europe and North America. However this pilot project has two strategic advantages that should be evaluated in the context of a demonstration project. One is the capability of the selected technology to destroy ODS exclusively rather than co-disposal with other waste streams, something that substantially enhances the verification of ODS destruction (particularly in the context of meeting protocols for carbon credit schemes) and demonstrate environmental performance. The second is the potential for demonstrating self-sufficiency in this important area of environmental management, nationally and potentially regionally. This approach is generally consistent with that advocated by the Basel Convention.

To reduce the overhead cost (personnel, ODS recovery equipment and space rental) and for efficient coordination, the operation of the destruction center will be sub-contracted out to existing importer or distributor of refrigerant with suitably equipped ODS recovery facility (vacuum pump/nitrogen system for the full purging of cylinders) through a performance based bidding process (see TOR in Appendix 4). Comprehensive training will be provided during the installation of the plasma machine and built in sensors will help to troubleshoot and identify potential faults in minimizing breakdown and downtime. A service contract will not be required as online backup services could be provided via the internet by the supplier. This center will be manned by two trained technicians with potential to operate two full 8 hours shifts.

The subcontracted sum will be paid under the MLF ODS pilot project (Table 4). Where possible, the HCFC-22 from the commercial and domestic air-conditioners will be recycled for re-use to diminish the needs for ODS-imports. Heavily contaminated ODS will be destroyed locally (plasma). To allow for this, refrigerant-identifying equipment, a recycling unit and a set of storage cylinders will be purchased and their budget is shown below in Table 4.

A performance-based subcontract-arrangement will be utilized to kick start the project at the location of an existing refrigerant distributer or similar facility (private or public). For the purpose of establish the cost this subcontractor would have, we have broken it down in the budget as follows for a total of US$ 66,000 (see Table 4 - C).

Also, there will be no outside revenues for these operations during the demo-phase. Payments will be made based on the amounts of ODS destroyed (except for the initial upfront payment for the first 6 months).

Technical performance

Measures will be put in place to ensure that the operation of the plasma arc machine comply with all the local environmental and health and safety standards and regulations. Manufacturer's data on representative ODS indicates that the waste water discharge of the proposed plasma arc machine will meet local standards. There are approximately 3.47 kg of CaF2 & CaCl2 generated for every kg of CFC-12 or 2 kg of HCFC-22 destroyed. In a year, there are about 16.6 t of CaF_2 & $CaCl_2$ generated if 4.8 t of CFC-12 or 9.6 t HCFC-22 are destroyed from two shifts. As there is no market for these by-products, the CaF_2 & $CaCl_2$ could either be landfill or mix with cement to make concrete as is practice in Japan.

Test performance of the plasma arc machine has shown a decomposition rate of 99.99 with no dioxin emissions detected[1].

$$\text{Decomposition rate (\%)} = \left(1 - \frac{\text{fluorocarbon in effluent gas}}{\text{total fluorocarbon fed}}\right) \times 100$$

	Fluorocarbon in effluent gas (v/v %)	Total fluorocarbon fed (v/v ppm)	Decomposition rate (%)
R12	99.6	4	＞99.99
R22	97.8	5	＞99.99
R134a	99.6	<1	＞99.99

The plasma arc machine has a moderate electricity consumption of about 6 kW of electricity for every 10 kg of ODS destroyed. The carbon emissions from the transport of ODS and energy consumption of the plasma arc machine will form part of the carbon leakage which has to be taken into account for the final calculation of carbon credits. The national grid emission factor will also influence the final carbon credit as 60% of the Ghana energy mixes come from hydropower.

[1] *Makoto Ohno, Yasuhiro Ozawa and Taizo Ono,2007.* ***Decomposition of HFC134a Using Arc Plasma.*** International Journal of Plasma Environmental Science & Technology Vol.1, No.2, SEPTEMBER 2007

b. Total cost of the disposal activity including costs not covered by the Multilateral Fund, the sources of funding for covering these costs.

The total investment and operation cost for the destruction of ODS using the plasma machine is shown in Table 4. The annual plasma destruction cost is estimated at USD 12.18 per kg ODS. This 'learning by doing' pilot will help to demonstrate on how to further reduce the operating cost through economies of scale and by increasing labor and machine productivity through good maintenance of the equipment, efficient management and minimization of down time.

c. Project sustainability of the underlying business model.

In order to ensure project sustainability and beyond the demonstration phase, the following risks have been identified for mitigation actions.

Table 3: Mitigation of risks

Types of risks	Potential Risks	Status	Mitigation actions
1. Technical	- Frequent breakdown of machine - Insufficient EOL ODS for destruction - Erratic power supply - Availability of cost effective chemicals -Identification of ODS in contaminated waste	Medium	- Comprehensive training during installation with excellent online backup services - Built in sensors for rapid pin pointing the source of faults. - Attractive rewards will prevent deliberate ODS leakage during de-manufacturing and servicing - Ministry of Environment will discourage export of ODS and encourage import of ODS from ECOWAS regions
2. Financial	- High capital and operation cost - Low turn in due to unattractive incentives - Lack of funding beyond the demonstration phase - Low carbon price - Prevention of perverse incentive in the destruction of virgin ODS for generating carbon credit	High	- This 'learning by doing' pilot will help to identify and overcome the barriers for the scaling of ODS project in West Africa - Maximize labour and machine productivity through good training and monitoring, reduce downtime and waste and create project ownership - Generate high quality ODS carbon credit for fetching the highest carbon price through transparent monitoring and traceability - To avoid reliance on carbon market, other financial models such as bilateral grants and EUA auction will be explored.
3. Institutional	- Poor coordination and commercial relationship between GEF EE, HPMP and ODS destruction center for the collection, recovery and destruction of ODS - Lack of local support	Low	- Sub-contracting the operation of the ODS destruction to importers or distributors with ODS recovery facility through a bidding process - Promote public awareness campaign to generate greater public and private sector buy in
4. Regulatory	- Poor enforcement of the new Energy Standards an Label program - Poor understanding of carbon	Low	- Provide good training to custom and enforcing officers - Provide comprehensive training for understanding the procedures, rules and criteria

	project protocol and methodology for generating high quality carbon credits		for generating high quality ODS carbon credit.

The MLF funding will cover for the implementation and operation of the pilot project for 3 years. Thereafter carbon credit could be used to scale up the project. The impact of ODS volume recovered from different refrigerator units recycled and potential Voluntary Emission Reductions (VER) carbon prices on project profitability is shown in Figure 3. To breakeven, at least 30,000 units would need to be turned in annually for the recovery of 2.4 t of CFC-12 to give a VER of 22,500 tCO2e and to fetch at least USD 3/tCO2e (VER). This meant that the plasma machine would have to operate at 1 shift for 8 hours in order to break even. When operating at two shifts a day to destroy 4.8 t of CFC-12 would give a profit is USD 32,280 with transaction cost of USD 30,000 (PDD, validation, registration, etc).

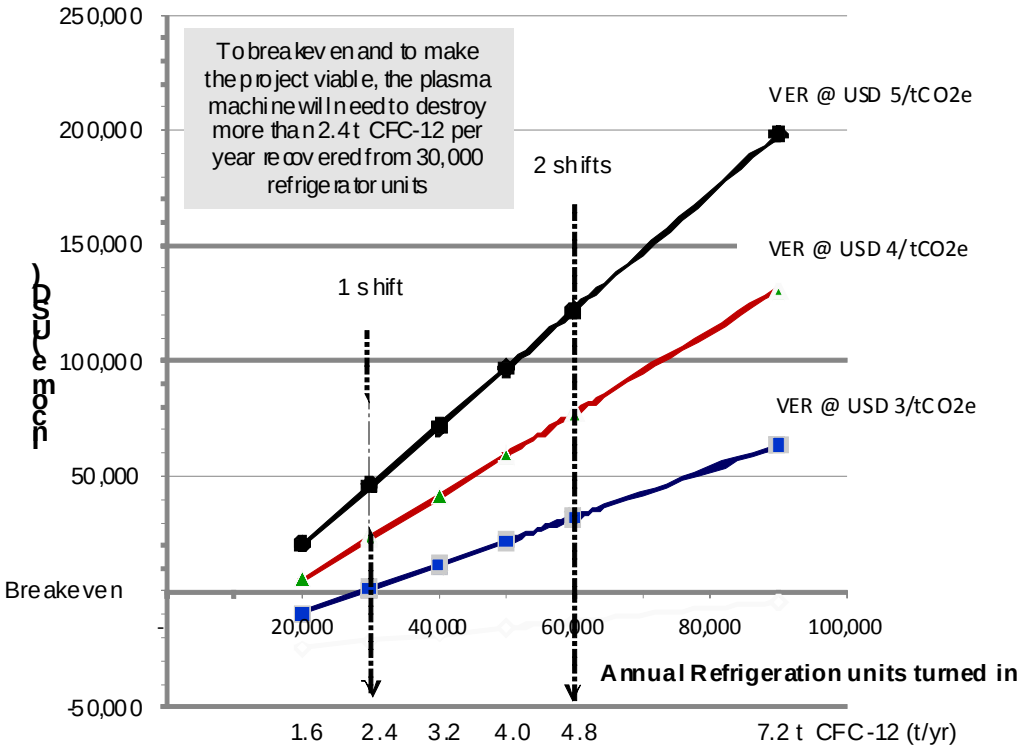
At the end of the three years of GEF and MLF funding, it is hoped that whatever ODS that can be recovered from the continuation of the Ghana project will be combusted and converted into carbon credits. Ghana intends to turn in 1 million old refrigerators over 10 years. This would translate into 100,000 refrigerators per year, but to take a more conservative estimate of 30,000 refrigerators per annum = 2.4 t or more CFC-12 per year, which would be as a follow up to the GEF project.

It should also be noted that the CFCs would gradually be complemented with HCFCs and HFCs, all of which would be eligible under either the Kyoto Mechanism or Voluntary Market mechanisms.

USG Umweltservice GmbH has recently submitted a methodology (Greenhouse Gas Emission Reductions by Recovering and Destroying Ozone Depleting Substances (ODS) from Products) for the destruction of ODS (CFC-12 refrigerant and CFC-11 blowing agent in insulation foam) for approval by VCS. This methodology has been opened for public comment from 5 May 2010 till 3 June 2010 (http://www.v-c-s.org/methodology_ggerrdods.html). Once approved, the Ghana project could use this methodology for claiming carbon credits. Due to monitoring and verification issue, Climate Action Reserve (CAR) at present would only accept project where the ODS are destroyed in the USA under stringent monitoring protocol.

Eligibility for accessing these carbon funds would only start after the MLF-demonstration would be completed (due to the "additionality" issue), and this, further to the fact that the sustainability of the operation will have been demonstrated thanks to this demonstration project.

Fig 3: Impact of annual ODS volume destroyed (recovered from various refrigeration units) and VER prices on project viability



d. Identification of time-critical elements of the implementation, which subsequently might be used to monitor progress.

In order to ensure that all the ODS are properly monitored and accounted for, stringent monitoring and verification plan will be put in place to avoid double accounting and irresponsible error. Traceability and chain of custody will be developed to ensure transparent and accountable monitoring. Such best practices will inculcate care and ownership and good governance.

For domestic destruction using plasma machine: Technicians will be trained to operate and maintain the plasma machine with backup services put in place. Stringent monitoring plan (record keeping, chain of custody, training) will be put in place to ensure good record keeping as shown in Figure 4. Best practices with high standards on health and safety will be observed in all operations of the project.

3.3. Other sources of funding.

This 'learning by doing' pilot will provide valuable lessons to overcome the technical, financial, regulatory and institutional barriers for the mainstreaming of ODS waste management for the

ECOWAS and other African regions. In order for the project to be sustainable and replicable, various fiscal and market based funding sources will be explored. With regards to financial incentives for ODS collection to complement the destruction pilot, the following will be noted:

- A grant of USD 1.72 million is allocated under GEF for the collection and recovery of ODS wastes from early retired or End-of-Life (EOL) refrigerators. The GEF-grant is complemented by US$ 200,000 of co-financing by UNDP and US$ 3,000,000 of co-financing by the Government. The GEF-project will cover for the collection and dismantling cost of the ODS-containing equipment. In addition, the opportunity to convert the energy gains into carbon credit as programmatic CDM to generate extra revenue will be explored. Another source of revenue is the selling of scrap metals form the dismantling process. From the dismantling process, the scrap metal (metals, compressors, coils, plastic materials) recovered will be sold to scrap metals dealers as a source of revenues.
- Under the HPMP, a MLF grant of USD 1.35 million has been approved for the phase-out of HCFC-22 through enhanced recovery practice during refrigeration servicing. While some of the recovered HCFC-22 will be recycled for reuse, contaminated ODS will be destroyed through this pilot project.
- ODS credits could be generated from the destruction of ODS locally (under Voluntary Carbon Standard). The technical (methodology, Standards), regulatory (baseline, additionality, eligibility) and financial (viability, transaction cost) risks in developing the ODS carbon project will be evaluated along with UNDP MDG Carbon Facility. The potential carbon savings for Ghana is shown in Figure 3.
- To cushion against the risk of low carbon price, bilateral grant and EUA auction will be sourced during the two years duration of the pilot.

3.4. Concept for monitoring the origin of recovered ODS

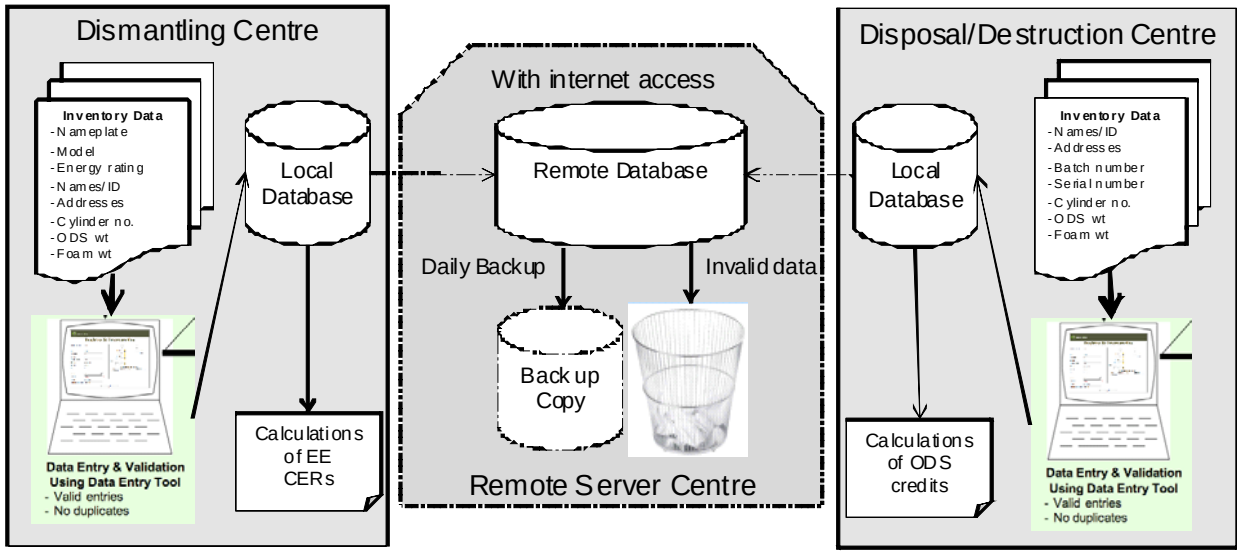
The objective of this monitoring is to discourage perverse incentive in the declaration of virgin ODS as used ODS for destruction. The transparent monitoring procedures will allow for external verification of the amounts destroyed, and the costs for its operation should be covered sustainably.

With the intention that the ODS recovered and destroyed could be monetized as carbon credits, a stringent detail monitoring and verification plan for both dismantling and destruction centres will be developed according to approved carbon protocol (e.g. CAR or VCS) so that all the baseline and project data and information captured and recorded can be validated and verified by independent third parties. Transparent and robust tracking system will be developed to cover the following facets: record on collection, transportation, storage at the 6 regional dismantling centres will be kept by the GEF EE project coordinator. Being first of its kind technology in Ghana, the national consultant and technicians will work in close collaboration with the international consultant and the technology provider to ensure that the monitoring and servicing plan and data collection are executed with high accuracy and in close supervision.

The technicians will record the volume of refrigerator, metal, foam and ODS recovered from the dismantling process. To ensure high Quality Assurance/Quality Control for carbon project,

technicians will be trained to record the number of ODS provisions to ensure that data acquisition and transcription are carried out consistently and with precision. Excellent chain of custody data will be developed to avoid the perverse incentive of virgin ODS being destroyed and to avoid double-counting of ODS destruction credits. For ODS to be exported: relevant data will be captured for verification purposes, document the full chain of custody from departure from origin country through to final destruction and develop methodology for analysing the composition of the ODS.

Figure 4: Monitoring and verification plan



3. 5. Assurances that the amount of ODS mentioned will actually be destroyed.

Attempts to provide these valid assurances and verification as transparent Certificate of Destruction are covered in Item (iv) above and in Figure 4 to ensure traceability, integrity and transparency. The computer data source with good backup system will allow third party validation and verification deem essential for developing high quality carbon project. Such high integrity and transparent tracking system will allow all stakeholders to put good governance and accountability into practices.

3.6. Exploration of other disposal options for the used ODS.

Relatively large amounts of refrigerant (CFCs, HCFCs, HFCs and HCs) will be collected from various ongoing GEF EE refrigerator replacement and TPMP/HPMP servicing centers. Where possible, ODS will be recycled for reuse to reduce the need for import. In transition to a full destruction scheme, the opportunity to recycle and reuse the ODS as an initial alternative to

destruction according to international best practices will be considered by taking into account the following considerations.

- market opportunities for recycled ODS
- Minimum quality standards required for recycling or reuse
- Selling price. Factors that will favour decisions for re-use or recycling:
    - Purity of available substance;
    - Equipment age and condition;
    - Existing equipment relying on specific substance without low cost retrofit;
    - Lack of immediate replacement technologies;
    - Likely future demand for the substance
    - Social/Economic impact of refrigerant shortage
- Factors that will favour decisions for ODS destruction:
    - Mixture of ODS or significantly contaminated substance;
    - Desire to accelerate technology transition;
    - Linkage with wider waste programme at product/equipment level;

The technical and economic feasibility to establish a reclaim center will be assessed. Through the distillation of mixes of refrigerants, the reclaim centre would be able to separate out various refrigerants and make them available in quasi-virgin state. The amounts would therefore be used to avoid imports of equivalent amounts of refrigerant. There may however still be certain quantities of refrigerant that cannot be processed and these will be destroyed.

4. PROJECT COSTS

Table-4: Project Budget – cost estimation

Estimation of available ODS		Unit	Tons
	ODS stock in storage (with Ghana-EPA)		1.8
	ODS from the GEF EE Programme	50,000 refrigerators	5.8
	From ongoing and future R&R schemes	10,345 refrigerators	1.2
	From ECOWAS imports of ODS-Waste		6.0
			14.8

Cat	**Budget**	**Unit**	**US$**
	A. Capital cost		
Equipment	Plasma Arc	1	100,000
	Transport Japan-Ghana	1	5,820
	Installation Cost	1	14,333
	Transformer	1	3,175
	Stabilizer	1	25,397
	UPS Battery Backup	1	20,952
	Identifier, Cylinders, etc	1	15,000
	Total capital cost		**184,677**
Transport	**B. Transport cost**		
	Transportation from Dism and R&R Centres	@ 2 US$/kg	14,000
	Transportation from ECOWAS region	@ 3 US$/kg	15,000
	Total transport cost		**29,000**
	C. Sub-contract cost to operate the facility (see draft-TOR in Appendix 4)		
Personnel	Two technicians working two 8-hour shifts*	2 persons	54,000
Facility	Space, security, electricity, water, AC in existing facility*		6,000
	Operating Costs Machine (Chemicals, Maint)*		6,000
	Total sub-contract cost		**66,000**
Support	Part-time National Consultant	1 person	23,500
	International Consultant	1 visit/yr	23,500
	Awareness Raising Workshop	1	5,000
	Total cost		**52,000**
	Grand Total		**331,677**
	Project Cost Effectiveness (USD/kg CFC-12)		**22.4**

*** Lines with asterisks are indicative and given for estimation-purposes only, as they will be part of a performance-based subcontract (see draft TOR in appendix 4).**

UNDP requests a grant for this project amounting to:

US$ 331,677 (excludes 7.5% support costs).

Scenario 2: Export from Accra to France	US$ per kg	US$
Transport cost from Dismantling centre to Port Tema	2.00	
Transhipment cost from Port Tema to Tredi/France	5.00	
Transport cost from Port to Tredi ODS destruction facility	2.50	
Gate fee for ODS destruction at Tredi, France	6.00	
Total (USD/kg)	15.50	223,200
Other Costs		
Part-time National Consultant		22,000
International Consultant		22,000
Awareness Raising Workshop		5,000
Storage Costs at the port, cylinders, customs clearance, etc		30,000
Total (USD)		302,200
4.8 t CFC-12/yr		14.4
Cost Effectiveness (USD/kg)		21.0

5. IMPLEMENTATION/MONITORING

Table-5: Implementation Schedule

TASKS	2010	2011				2012				2013		
	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q
Project Start-up												
MF Project Approval	X											
Receipt of Funds		X										
Grant Signature		X										
Procurement arrangement (Bidding for plasma and transport)		X										
Phase I – Training and trial												
- Arrival of Plasma machine and chemicals			X									
- Training by supplier			X									
- Trial and Testing			X									
- Analysis/Reporting/ preparation phase II			X									
Phase II - Operation												
Operation for 24 months				X	X	X	X	X	X	X	X	
Monitoring by local consultant					X		X		X		X	
Mid term Reporting								X				
Final report											X	

Table-6: MILESTONES FOR PROJECT MONITORING

TASK	MONTH*
(a) Project document submitted to beneficiaries	1
(b) Project document signatures	2
(c) Procurement	2,3
(d) Phase 1 – Training and trail runs Plasma machine and chemicals delivered	4
(e) Training and Trial Runs	4
(f) Testing/analysis/reporting	5
(g) Phase II - starts operation	6
(h) Mid-term review – analysis/reporting	12
(i) Phase II project closure – final reporting	24

* As measured from project approval

6. ANNEXES

Appendix 1: Letter of Intent by the Minister of Environment to safeguard the supply of ODS in Ghana

Appendix 2: Public Notice by the Energy Commission on Energy Efficiency Standards and the Prohibition of the Manufacturing, Importation and Sale of Used Refrigerators in Ghana

Appendix 3: GEF EE Turn In Program to collect old refrigerators for ODS recovery

Appendix 4: Terms of Reference for a Sub-contractor to operate and destroy ODS wastes in Ghana

Appendix 5: Estimated cost for the collection and recovery of ODS to be funded by GEF EE project in Ghana

Appendix 6: Quotation for Asada machine and technical data

Appendix 7: Ghana ODS Destruction Pilot Annex- Legal Framework

Appendix 1: Letter of Intent by the Minister of Environment to safeguard the supply of ODS in Ghana

In case of reply, the Number and date of this Letter should be quoted.

Our Ref: MESt/SCA/103/V.2

Your Ref: ....

Tel: 021-662 533 / 666 049
Fax: 021-666 813 / 662 533

Republic of Ghana

Ministry of Environment, Science & Technology
P.O. Box M232
Accra

2nd September, 2010

The Chief Officer
Multilateral Fund for The Implementation
Of the Montreal Protocol
1000 De La Gauchetiere West
Suite 4100, Montreal Quebec
Canada H3B 4W5

ESTABLISHMENT OF AN ODS WASTE DESTRUCTION FACILITY IN ACCRA, GHANA.

As you may recall Ghana submitted two project proposal – Hydrochlorofluorocarbon Phase out Management Plan (HPMP) and Ozone Depleting substances (ODS) Waste Destruction Project to the 61st Executive Committee (Excom) for consideration and approval. Whereas the HPMP project was duly approved, the ODS Waste Destruction Project was not due to a degree of uncertainty of the availability of substantial quantities of ODS's that could be generated locally to make the project sustainable in the long term.

The establishment of the proposed ODS Waste destruction centre project is a priority for Ghana and we hereby commit to:-

- Prevent export of ODS waste from Ghana to other countries for destruction.
- Channel ODS waste that will be generated from the GEF-funded Energy Efficiency project to the destruction facility which is to be established.
- Allow ODS waste from neighbouring West African countries to be sent (imported) to Ghana to feed the destruction centre.

We are by this letter requesting UNDP to re-submit our ODS Waste proposal, together with other issues as addressed to the 62nd ExCom for consideration.

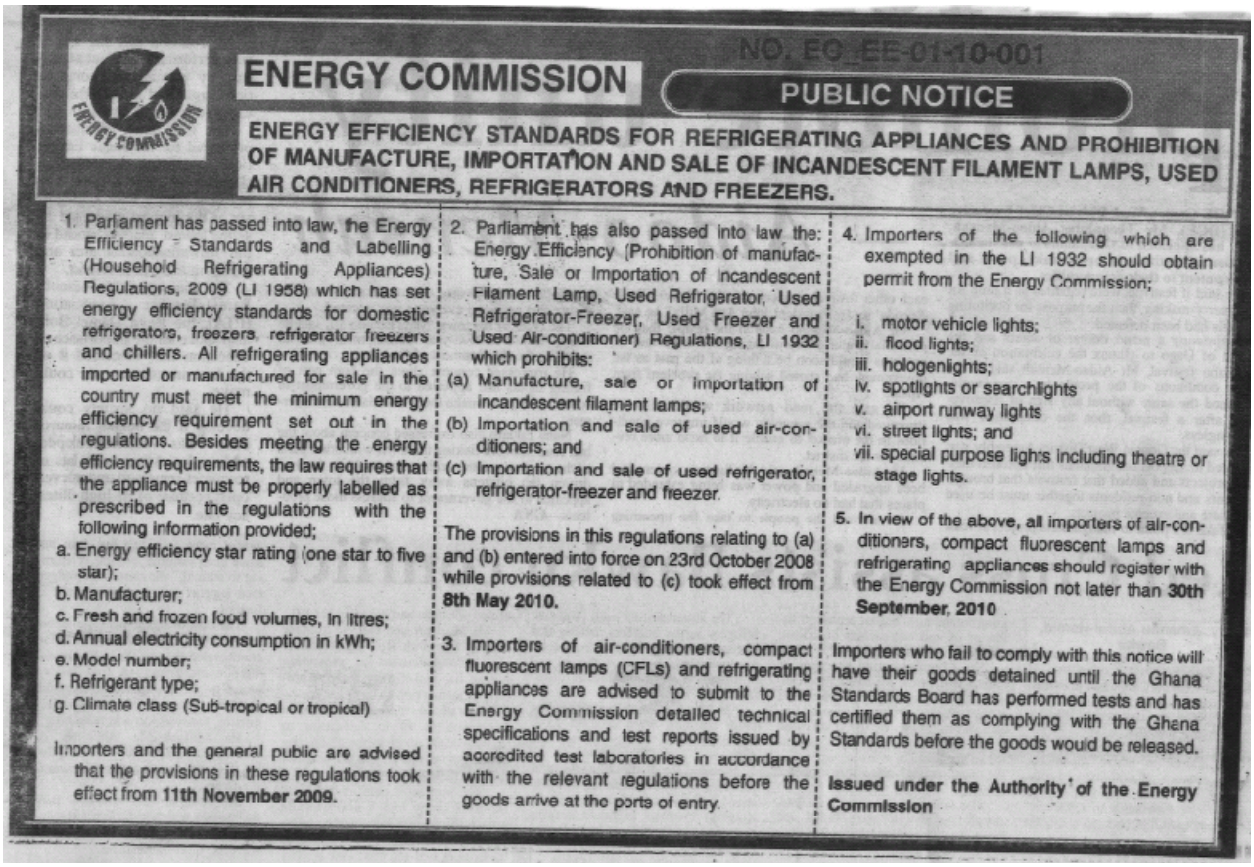
We are counting on your usual cooperation.

Yours faithfully,

HON. SHERRY AYITTEY (MS)
MINISTER

Cc: The Resident Representative
U.N.D.P.
Accra

Appendix 2: Public Notice by Energy Commission on the Energy Efficiency Standards and Prohibitions (as advertised in national newspaper in August 2010)



NO. EC_EE-01-10-001

ENERGY COMMISSION

PUBLIC NOTICE

ENERGY EFFICIENCY STANDARDS FOR REFRIGERATING APPLIANCES AND PROHIBITION OF MANUFACTURE, IMPORTATION AND SALE OF INCANDESCENT FILAMENT LAMPS, USED AIR CONDITIONERS, REFRIGERATORS AND FREEZERS.

1. Parliament has passed into law, the Energy Efficiency Standards and Labelling (Household Refrigerating Appliances) Regulations, 2009 (LI 1958) which has set energy efficiency standards for domestic refrigerators, freezers, refrigerator freezers and chillers. All refrigerating appliances imported or manufactured for sale in the country must meet the minimum energy efficiency requirement set out in the regulations. Besides meeting the energy efficiency requirements, the law requires that the appliance must be properly labelled as prescribed in the regulations with the following information provided;

a. Energy efficiency star rating (one star to five star);
b. Manufacturer;
c. Fresh and frozen food volumes, in litres;
d. Annual electricity consumption in kWh;
e. Model number;
f. Refrigerant type;
g. Climate class (Sub-tropical or tropical)

Importers and the general public are advised that the provisions in these regulations took effect from **11th November 2009.**

2. Parliament has also passed into law the: Energy Efficiency (Prohibition of manufacture, Sale or Importation of Incandescent Filament Lamp, Used Refrigerator, Used Refrigerator-Freezer, Used Freezer and Used Air-conditioner) Regulations, LI 1932 which prohibits:

(a) Manufacture, sale or importation of incandescent filament lamps;
(b) Importation and sale of used air-conditioners; and
(c) Importation and sale of used refrigerator, refrigerator-freezer and freezer.

The provisions in this regulations relating to (a) and (b) entered into force on 23rd October 2008 while provisions related to (c) took effect from **8th May 2010.**

3. Importers of air-conditioners, compact fluorescent lamps (CFLs) and refrigerating appliances are advised to submit to the Energy Commission detailed technical specifications and test reports issued by accredited test laboratories in accordance with the relevant regulations before the goods arrive at the ports of entry.

4. Importers of the following which are exempted in the LI 1932 should obtain permit from the Energy Commission;

i. motor vehicle lights;
ii. flood lights;
iii. hologenlights;
iv. spotlights or searchlights
v. airport runway lights
vi. street lights; and
vii. special purpose lights including theatre or stage lights.

5. In view of the above, all importers of air-conditioners, compact fluorescent lamps and refrigerating appliances should register with the Energy Commission not later than **30th September, 2010**

Importers who fail to comply with this notice will have their goods detained until the Ghana Standards Board has performed tests and has certified them as complying with the Ghana Standards before the goods would be released.

Issued under the Authority of the Energy Commission

Appendix 3: Turn In Program of the GEF EE project for the collection and storage of ODS

Registration of importers

The process starts with registration of importers refrigeration appliances by the Energy Commission. All importers and future manufacturers of refrigeration appliances will have to comply with the minimum energy efficiency requirements; this is mandatory. However, compliance with higher energy efficiency standards is voluntary.

For the purposes of clarification, an importer is the person or company that imports the appliances. The dealer is the retailer. It is worthy of note that in Ghana, most importers have retailer outlets as well. The importers will be needed to submit test reports to assure the Commission that the appliances meet the required minimum standards. It is the importer who the Commission will deal with in the release of coupons.

Certification and labeling regime

With the introduction of labeling and certification regime, all imported refrigerators that are properly labeled and accompanied by certificates will be immediately released by the Ghana Standards Board. Appliances without labels will be detained until the technical details have been provided and the efficiency level determined. A printing firm will be pre-qualified to print labels to be affixed on the appliances that meet the minimum requirements. Those that do not meet the requirements will have to be re-exported.

Participation in the rebate scheme

Participation in the refrigerator rebate scheme is voluntary. Importers that opt to deal in higher efficiency appliances will register with the Commission and they will be given certificates and special stickers to be displayed in front of their shops. The importers of higher efficiency appliances will submit test reports from accredited test laboratories to the Energy Commission who will in conjunction with Ghana Standards Board, determine the efficiency level. Coupons will then be issued corresponding to determined efficiency levels with predetermined rebate values to the importer.

The Table below gives an estimated average annual consumption and saving for each star rating.

Star Rating	Annual Energy Consumption of Refrigerator, kWh	Annual Energy Savings of Refrigerator, kWh
5 star	250	950
4 star	350	850
3 star	400	800
2 star	500	700
1 star	600	600

Administration of the Rebate

The Energy Commission will appoint a participating bank where the rebate funds will be lodged. Security-enhanced coupons will be issued in quadruplicate by the Energy Commission and entered into a data base; one copy each of the coupon will be put on the records of the Commission and that of the participating bank. The remaining two copies of the coupon will be issued to the participating importer, and they will be completed at the time of purchase by the buyer, and then signed and stamped by the dealer. The dealer will retain one of the coupons whilst the buyer will keep the other coupon and use its value as part payment for the refrigeration appliance by submitting it to the participating bank for redemption. The bank will honour the coupon after having satisfied itself of the authenticity of the coupon (i.e. serial number, security features etc).

Checks against fraud

In order to ensure the scheme against fraud, the participating bank will redeem coupons from only registered importers after it is satisfied that the serial numbers are correct and that there is an Energy Commission stamp duly affixed. Buyers may be visited at random to certify that the refrigeration appliances are indeed at the buyer's premises.

Appendix 4: TERMS OF REFERENCE FOR A SUBCONTRACTOR TO OPERATE AND DESTROY ODS WASTE IN GHANA

The services of a subcontractor are being sought under the framework of the ODS-Waste Destruction Programme for Ghana, to be funded by the Multilateral Fund for the Implementation of the Montreal Protocol and implemented by the United Nations Development Programme (UNDP) in collaboration with Ghana-EPA. The National Ozone Unit at Ghana-EPA and UNDP wishes to retain the services of company XXXX represented by Mr. YYYY, with the following address and email-contact:

ZZZZZZZZZZZZ

ZZZZZZZZZZZZZZZZZZZZ

ZZZZZZZZZZZ

YYY.YYYY@ZZZZ.COM

The specific objectives of this subcontract are as follows:

1) To provide space, electricity, water and human resources to operate the ODS-waste destruction unit that will be purchased by UNDP outside the scope of this sub-contract. Peripheral equipment that would also be purchased by UNDP would include the following:

Transformer
Stabilizer
UPS Battery Backup
ODS Identifier, Cylinders, etc

The equipment supplier will be responsible for the installation of the ODS-waste equipment and will provide comprehensive initial training with subsequent online technical support to the subcontractor (the costs of which would also be outside the scope of this subcontract).

2) The subcontractor in close collaboration with the national consultant will commit to provide high quality and professional services for the safe operation and maintenance of the destruction equipment which would remain the property of UNDP until the end of the project, when they

will be transferred to the recipient subcontractor through the Government with the signature of a Handover Protocol (HOP).

3) The subcontractor will designate personnel who would be able to operate and maintain the equipment. As the volume of ODS waste to be processed increases, it is envisaged that two non-overlapping 8-hours shifts would be required for achieving the target of the project (14.4 metric tons of ODS-waste).

4) ODS-waste in refillable cylinders will be brought to the site of the subcontractor for destruction, and the transportation costs of the ODS cylinders will fall outside the scope of this subcontract. However, the subcontractor will be responsible for the identification and accurate recording of the ODS-waste to be received at the site and destroyed according to the stringent monitoring plan. Waste products from the destruction-process will have to be disposed off by the subcontractor in a safe and environmentally sound manner as stipulated in the project monitoring plan.

5) The subcontractor will prepare 6-monthly reports about the daily activities that were performed at the destruction centre, including information about the quantities of each ODS consignment that were received and destroyed during the period concerned, Six-monthly payments will be based on these reports as elaborated upon below.

Duration of the subcontract

This subcontract will last until the target amount of ODS-waste stipulated below have been destroyed. It is anticipated that this may take up to 2 to 3 years.

Remuneration

a) The subcontract is performance-based, which means that the subcontractor will get an initial 6-month advance of US$ 11,000 upon signature of the contract to allow for the start of the operations, but that further 6-monthly payments would be based on the quantities of ODS-waste destroyed during the preceding 6 months, which would be calculated as US$ 3,820 per metric ton of ODS-waste destroyed.

b) The 6-monthly payments would continue till the maximum ceiling of US$ 66,000 is reached. As such, the amount of ODS-waste that would have been destroyed at the end of the subcontract arrangement would amount to USD 55,000 / 3,820 = 14.4 metric tons which corresponds to the overall objective of the demonstration-project.

c) As mentioned above, and except for the initial payment, further payments would be based on 6-monthly reports by the subcontractor which will be verified by the independent National Consultant, and further endorsed by the NOU and UNDP-Accra.

Signed by NOU	**Signed by UNDP-Accra**	**Signed by the Subcontractor**
----------	----------	----------
Date :	Date :	Date :

Appendix 5: Estimated cost for the collection and recovery of ODS to be funded by GEF Energy Efficiency project in Ghana.

1. Cost for ODS destruction using plasma arc machine for 4.8 t CFC-12 recovered from 60,562 refrigerator						
Data provided are indicative only, project implementation will verify these data.						
		Unit	**kg**	**Total**		
CFC-12 stored in M4499 cylinders		114	42.5	**4,845**		
Metal and scraps		60,562	10.00	**605,620**		
CFC-12 as refrigerant		60,562	0.08	**4,845**		
Total				**610,465**		
A. Collection and aggregation cost of refrigerators at retailers/NARWAO workshops		**Unit**	**Unit Cost (USD)**	**Total (USD)**	**Funding source**	**TEAP Cost (USD/kg)**
Metal and scraps		605,620	1.00	**605,620**		
CFC-22 in refrigerators		4,845	10.00	**48,450**		10-15
Total		60,562	10.80	**654,070**	**GEF EE**	
*** TEAP costing based on medium effort with sparese population e.g. Ghana**						
B. Transport cost of appliances from retailers/Narwao workshop to 6 Regional Dismantling centres		(Between 200 to 1,000 km)				
Metal and scraps		605,620	2.00	**1,211,240**		
CFC-22 in refrigerators		4,845	20.00	**96,899**		30-40
Total		60,562	21.60	**1,308,139**	**GEF EE**	
C. Annual Recovery cost at 6 Regional Dismantling and Recovery Centres						
Total Dismantling capacity per year	6 X 34 X 25 X 12 = 61,200 units					
Dismantling capacity Per centre	6 x 34 x 25 = 5,100 units/yr			850 units/mth		
Rental of National Depot		6	4,000	24,000		
Supervisor (1 per centre)		6	4,000	24,000		
Trained Senior Technician (2 per centre)		12	3,500	42,000		
Trained Shredders/Packers (6 per centre)		36	2,500	90,000		
Telephones, faxes etc p.a.		6	1,000	6,000		
Group Security Staff (1)		12	2,000	24,000		
Utility Costs (Elect & Water /pa)		6	4,000	24,000		
Lot Office Equipment		6	2,000	12,000		
Lot Furniture & fittings		6	2,000	12,000		
Tools/accessories		6	5,000	30,000		
ODS cylinders		684	15	10,260		
Sub-total				298,260		
Add 10% Contingencies		1	29,826	29,826		
OPEX Cost				**328,086**	**GEF EE**	
Breakdown						
Metal and scraps		605,620	0.31	**185,159**		
CFC-22 in refrigerators		4,845	4.00	**19,380**		
Total		60,562	3.38	**204,539**	**GEF EE**	
Cost/kg (USD/CFC-12)		4,845		4.00		10-20
Cost/kg (USD/HCFC-22)		9,690		2.00		
D. Transport cost from 6 Regional Dismantling Centres to Accra ODS Destruciton center						
Transport cost						
Metal and scraps		605,620	0.10	60,562		
CFC-22 in refrigerators		4,845	3.00	14,535		1
Total		60,562	1.24	75,097	**GEF EE**	

Appendix 6: Quotation for Asada machine and technical data

Asada
ASADA CORPORATION
3-60 KAMIIDA NISHI-MACHI,KITA-KU,NAGOYA,462-8551 JAPAN
TEL:(81)52-914 1206 FAX:(81)52-914-2011

QUOTATION

Date May-27 2010

Messrs: Dr Jason Yapp
UNDP Consultant

N Q100527

Shipment: BY SEA FREIGHT

On or Approx 4 months after Contract

From: NAGOYA

To ACCRA, GHANA

Payment: By T/T

Reference:

Code	Description	Quantity	Unit Price	Amount
	CFC, HCFC DECOMPOSITION MACHINE			
	MODEL PLASMA X, 200V/3PH Cossitst of Decomposition Unit Dehydration Unit Nitrogen Generation Unit Cooling Tower Air Compressor	1 SET	FOB Japan ¥=Jap.N.R.Yen ¥9,450,000	¥9,450,000
	Transformeer (Input 380V/poh, Out put 200V/3 ph,	1 SET	¥300,000	¥300,000
	SPARE PARTS FOR 2,400hours Operation	1 SET	¥1,112,000	¥1,112,000

TOTAL : 2 SETS ONLY

TOTAL FOB JAPAN	Japansese Yen10,862,000
SEA FREIGHT CHRGE TO ACCRA	Yen550,000
INSURANCE CHARGE	Yen40,000
GRAND TOTAL CIF ACCRA	Yen11,452,000
(Equivallent to US Dollars	US$127,244,440)

Main Features of Plasma X

Superb decomposition capacity
"Higher than 99.9% decomposition rate.
Safety Assurance
Equipped with Safety System which stops operation by monitoring water disposal and exhausting gas.'

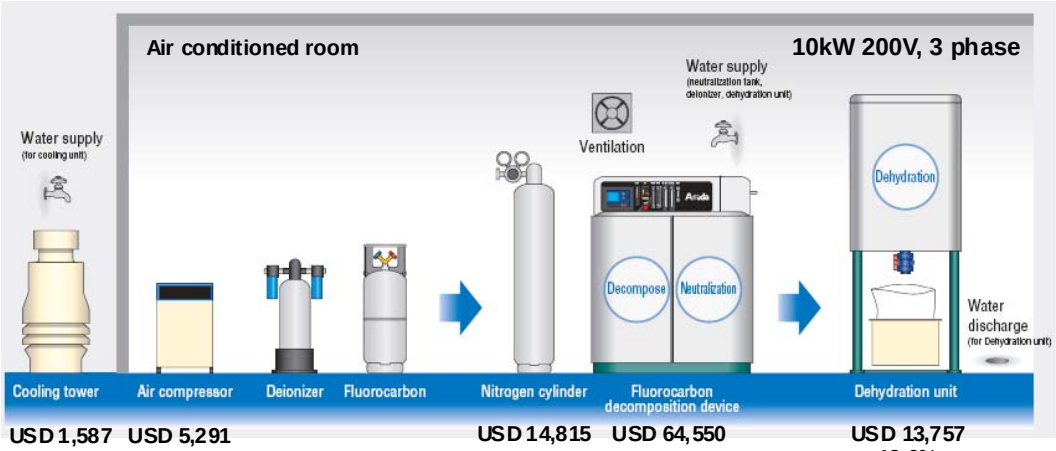
Easy to operate by touch panel
(ease-of-use in case of exchange of operating personnel,)
Easy maintenance

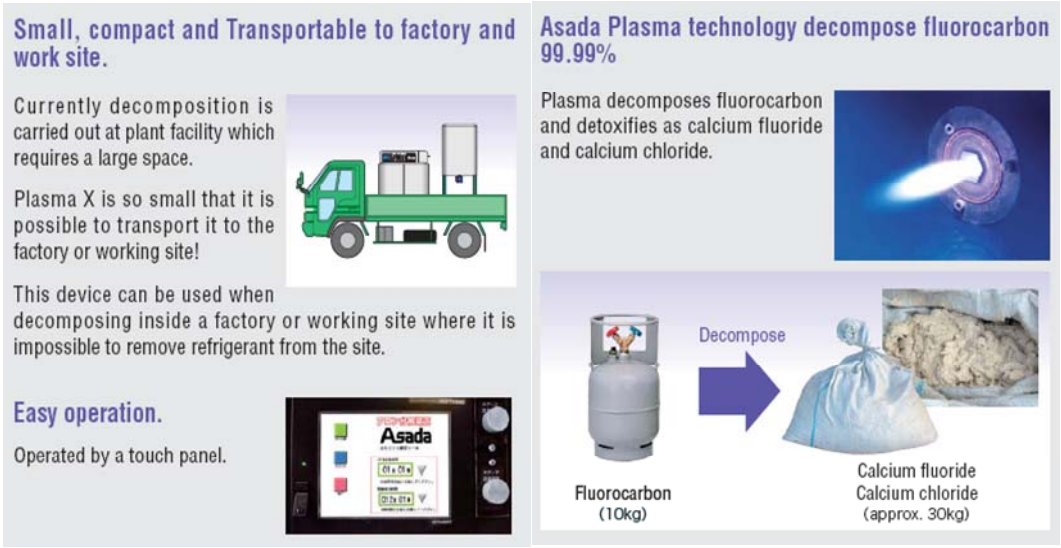
ASADA CORPORATION

TRADE MANAGER

Asada has confirmed that this mobile plasma machine has been developed and refined over the last 5 years. To date 2 units have been in operation in Japan clocking up to 500 hours of operation per year per machine. The practicality in suing this plasma as a mobile unit will be tested in the pilot. Asada has assured us that this plasma could operate a maximum of 20 hours per day and could destroy 10 kg of CFC-12 per batch with half an hour rest between plasma arc ignition. After an initial comprehensive installation training in Accra, Asada will continue to provide online support services through the internet. One such plasma machine is currently being installed in Argentina.

- **Can operate for up to 10 hours per day (1 batch) at 1 kg CFC12/hr or 2 kg HCFC22/HFC134a per hour (can handle contamination) – requires 6kW of electricity**
- **CAPEX = USD 100,000 and annual chemical cost = USD 3,000 (lime from local source)**
- **Cannot destroy PCBs and 1 unit being installed in Argentina (UNIDO project)**





Appendix 7: LEGAL FRAMEWORK

Ghana is a signatory to the Montreal Protocol on Substances that Deplete the Ozone Layer. The status of the ratification of this protocol and its Amendments is as follows:

Multilateral Environmental Agreement	Date of Ratification	Date of Entry into Force for Ghana
Ozone-related		
Vienna Convention on the Protection of the Ozone Layer	24 July 1989	22 October 1989
Montreal Protocol on Substances that Deplete the Ozone Layer	24 July 1989	22 October 1989
Montreal Amendment	24 July 1992	22 October 1992
Copenhagen Amendment	9 April 2001	8 July 2001
Montreal Amendment	8 August 2005	6 November 2005
Beijing Amendment	8 August 2005	6 November 2001
Climate-related		
United Nations Framework Convention on Climate Change (UNFCCC)	6 September 1995	5 December 1995
Kyoto Protocol	30 May 2003	16 February 2005