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EXECUTIVE COMMITTEE OF
THE MULTILATERAL FUND FOR THE
IMPLEMENTATION OF THE MONTREAL PROTOCOL
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Montreal, 12-15 April 2010

Addendum

PROJECT PROPOSALS: MEXICO

This addendum is issued to submit the comments and recommendation of the Fund Secretariat on the following project proposal:

Destruction

- Demonstration project for disposal of unwanted ODS (phase I) — UNIDO and France

PROJECT DESCRIPTION

Introduction

1. UNIDO, on behalf of the Government of Mexico and the Government of France as co-implementing agency, submitted to the 60th Meeting a "Demonstration project for disposal of unwanted ODS (phase I)". The project as originally submitted is addressing the disposal of up to 142.5 ODP tonnes of CFC-12 and 63.0 ODP tonnes of CFC-11 in the refrigeration sector by 2012, and also disposal of a further amount up to 1,575 ODP tonnes during the second project phase of ten years, for which no funding is required. The first phase of this project is meant to establish the facilities and start the operation, as well as generate income through credits; the second phase foresees a multi-year operation of the disposal facilities. UNIDO and the Government of France had requested a grant from the Multilateral Fund of US $2,723,000 plus agency support cost.

2. 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 disposal demonstration projects. The review of the Secretariat is being carried out based on the principles established through this decision. For this particular submission, the Secretariat would like to recall sub-paragraph (a) (ii) (a) of the decision, which specifies 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".

Relevant criteria for demonstration projects as per decision 58/19

3. The Executive Committee requested in this decision that any demonstration project on ODS disposal would cover only aspects not yet included in other demonstration projects. Since this project is the first submission of a demonstration project for ODS disposal this criterion is fulfilled. UNIDO indicated in their submission that, during phase I, activities are to be carried out in the categories of collection, transport, storage and destruction. Collection refers here to the extraction of ODS from refrigerators already collected, i.e. the costs of removing the CFC-12 and CFC-11 from the refrigerators and transferring them into transport containers.

4. The project proposal is closely related to a national incentive programme for the retirement of domestic refrigeration and air conditioning equipment. A very successful incentive programme was organized in 2005, where 604,000 domestic refrigerators have been replaced and, subsequently destroyed. In addition, 126,000 air conditioners have also been replaced and destroyed, leading to the recovery of 22 tonnes of CFC-12 and 88 metric tonnes of HCFC-22; CFC-11 from the foam in refrigerators has not been recovered. According to UNIDO the Mexican Government has established a further substitution programme for domestic refrigerators and air conditioners with a target of 1.6 million units to be collected between 2009 and 2012, which has already commenced operation. With this information, UNIDO provided a sound basis for the estimate of ODS to be recovered and, subsequently, destroyed.

5. UNIDO proposes to recover ODS from appliances using a two-step approach:

(a) In step one, the refrigerant is removed from the refrigeration cycle; UNIDO proposes to also remove the refrigeration oil and treat it to remove the CFC-12 dissolved in it and thus increase the efficiency of the CFC-12 recovery; and

(b) In step two, the refrigerator is entering a shredder, the shredded material is sorted and the polyurethane foam grinded. This destroys the cell structure of the foam and releases a significant portion of the CFC-11 within.

6. UNIDO also proposes a number of additional activities, such as using an existing cement kiln in Mexico for destruction of CFCs, purchasing a mobile plasma arc destruction facility for destruction of 1.5 tonnes (metric) of halon per year, and introducing a manufacturer liability scheme in the country. UNIDO informed also that collected ODS from the previous appliance replacement programme has yet to be destroyed.

7. UNIDO included extensive documentation related to the business model to ensure continued and sustainable operation of the destruction facility in phase 2, which provides, *inter alia*, the description required of the management and financial set up and a clear indication in how future funding is being thought and will likely contribute to the project.

SECRETARIAT'S COMMENTS AND RECOMMENDATION

COMMENTS

8. The Secretariat advised UNIDO that the collection of ODS from refrigerators is not eligible. However, once the refrigerant and foam blowing agent has been extracted, the further treatment of these ODS is eligible. The Secretariat consequently advised UNIDO that the costs for collection – other than a provision for monitoring – should not be part of the project costs.

9. Using the base information provided by UNIDO, the Secretariat undertook modelling of the financial viability of the overall project. The Secretariat believes that a number of the findings might be of general interest to the Executive Committee and has therefore, presented them in the following paragraphs in some detail.

(a) In case of this project, the refrigerators have already been collected and are concentrated in a few locations, as part of an energy efficiency / appliance replacement activity. In order to destroy the ODS, the substances have to be extracted from the appliances, transported and destroyed. The Secretariat looked only at the project and its impact starting with the already collected refrigerators;

(b) For removing CFCs from refrigerators in Mexico, the following options are available, listed by increasing complexity and costs:

(i) Removing the refrigerant from the appliance with relatively simple refrigerant recovery equipment; the "CFC-12 recovery-only" option. However, refrigerators have a large amount of refrigeration oils in their cycles, and the CFC-12 refrigerant is highly soluble in these oils. Using only a recovery process will leave a large volume refrigerant in the refrigeration oil;

(ii) In addition to removing the refrigerant, removing also the refrigeration oil and treating them to extract the CFC-12; the "CFC-12 recovery and oil-treatment" option;

(iii) In addition to (i) or (ii), the CFC-11 in the insulation foam can be recovered; this requires shredding of the refrigerators, sorting the material after the shredding, and feeding the foam into a mill to open the pores and release the CFC-11. The CFC-11 released in these processes has to be recovered from the air or gas present during shredding and milling; the "CFC-11 recovery" option;

(c) UNIDO proposes to generate income for sustainable, long term funding of refrigerator and CFC destruction by destroying CFCs under one of the carbon-trading mechanisms. In these cases, reductions in release of a greenhouse gas can be traded, if those reductions and how they are being measured have been achieved under an accepted protocol. Since CFCs are not covered by the Kyoto Protocol, only so-called voluntary markets might trade in these Verified Emission Reductions (VERs).[1] In February 2010, the "Article 5 Ozone Depleting Substances Project Protocol - Destruction of Article 5 Ozone Depleting Substances Banks" was published by the Climate Action Reserve (CAR)[2]; this is currently the only such protocol that would allow destruction of ODS from Article 5 countries. One of the provisions is that any destruction has to take place in the United States; consequently, if destruction capacity would be established in Mexico, there would be no eligibility for VERs, and, thus, no income under the current situation. The Secretariat advised UNIDO, and UNIDO agreed to adapt the project by removing the establishment of a plasma arc destruction facility and the use of a cement kiln in Mexico and replacing it by transport of recovered ODS to the United States for destruction;

(d) A number of other factors will influence the amount of CFCs recovered from the appliances, and any income which might be derived from destroying CFCs under a voluntary carbon standard:

(i) The future price for VERs is highly uncertain; since income from VERs is meant to provide sustained funding, the price fluctuations in VER prices lead to almost comparable fluctuations in the income under the project. Market information from January 2010 stated market prices for VER from the CAR at US $7/t CO_2. It should be noted that when issuing VERs, CAR issues only 80 per cent of the credits, retaining the remainder for the organisation itself. Consequently, income from VERs for any project would be only 0.8 times the market value of VERs;

(ii) Refrigerators being delivered to a recycling facility are in many cases functional and contain refrigerant, in some cases; any refrigerant losses might be due to losses during use or damage during transport. The Secretariat consulted a number of studies, according to which the share of refrigerant-containing refrigerators is about 70 per cent of all refrigerators delivered to European recyclers. The recycling efficiency using method (ii) is very high, with reported recovery of more than 90 per cent of the original charge for those system still functional. Assuming that 70 per cent of the refrigerators still contain refrigerant, amounting to 120g per refrigerator, about 76g of refrigerant could be recovered per unit entering into the recycling programme. In the past, Mexico only recovered according to method (i), and achieved an average of 36g per refrigerator entering into the recycling programme;

[1] VERs is the general name given to carbon offset credits in the voluntary carbon market. These are tradable credits for greenhouse emission reductions generated to meet voluntary demand for carbon credits by organisations and individuals wanting to offset their own emissions

[2] The Climate Action Reserve, CAR, is, according to information from their web-site, a national offsets programme in the United States with an aim to ensure integrity, transparency and financial value in the U.S. carbon market. It does this by establishing regulatory-quality standards for the development, quantification and verification of greenhouse gas reduction projects in North America; issuing carbon offset credits generated from such projects; and tracking the transaction of credits over time in a transparent, publicly-accessible system. Adherence to the Reserve's high standards ensures that emissions reductions associated with projects are real, permanent and additional.

(iii) According to the studies used by the Secretariat, recovery of the CFC-11 from the insulation foam yields in Europe in the order of 220g to 250g of CFC-11 (average recovery from multi-refrigerator tests, value differs depending on the facility); this value might be slightly higher for refrigerators from Mexico due to, on average, larger dimensions. For the modelling, the Secretariat assumed 285g per unit, consistent also with data provided by UNIDO;

(iv) The proportion of CFC refrigerators among all refrigerators to be collected is uncertain. The refrigerator industry in Mexico had converted mainly to HFC-134a/HCFC-141b between 1998 and 2004, and refrigerators are typically replaced between 15 and 25 years after purchase. However, UNIDO reported that in a previous refrigerator collection programme started in 2005, through which 604,000 refrigerators were collected, a number of HCFC/HFC appliances were included. With every year passing, the share of HCFC/HFC refrigerators will increase;

(v) When collecting refrigerators with HFC-134a/HCFC-141b, the substances can only be kept separate from CFC-12 and CFC-11 if a very rigorous identification and selection of the refrigerators is carried out pre-destruction. In Europe the selection accuracy is at 95 per cent, i.e. 5 per cent of the refrigerators might be associated with the wrong group. This leads to a likely recovery and/or shredding of non-CFC refrigerators, with the associated cost. In addition, it is likely that the recovery of refrigerant and blowing agent will result in a mix of HFC-134a/CFC-12 and HCFC-141b/CFC-11. These mixtures will incur similar transport and destruction costs depending on their total mass, but carbon credits will only be associated with the actual amount of CFC-11 and CFC-12 in the mixture since HCFC-141b and HFC-134a continue to be manufactured and are therefore ineligible. In addition, it is conceivable that the destruction cost for the mixture per kg might actually increase as compared to the destruction costs for pure substance;

(vi) The processing cost per refrigerator (including hardware cost) for this project has been estimated on the basis of literature data and UNIDO's information. It appears that the possible cost of the CFC-11 recovery option per refrigerator would be in the order of at least US $10. This figure is based on the source with the lowest cost assumption, i.e. the project proposal by UNIDO; while other sources specify up to US $30 per refrigerator. For the CFC-12 recovery-only option, a cost of US $0.5 per refrigerator was assumed, while for the CFC-12 recovery and oil treatment option, cost of US $2.5 per refrigerator was assumed. The difference between the two options is the recovery rate per refrigerator, which is twice as high for the option with oil-treatment and would achieve above 98 per cent CFC-12 recovery.

(e) On the basis of the above information, the Secretariat developed a complex model taking into account all of the above information, and using a refrigerator lifetime of up to 25 years with a logarithmic decline, with about 40 per cent of the refrigerators being replaced before reaching an age of 25 years. This was used to model the percentage of CFC refrigerators for recovery over the next decade vis-à-vis all refrigerators collected. It was assumed that 1.2 million refrigerators would be delivered over the next eleven years to a recycling centre, and that only those refrigerators containing CFCs are treated; in the last year of operation (2020), the share of refrigerators containing CFCs would reach 80 per cent, from an initial value of above 94 per cent;

(f) The Secretariat aggregated the annual income and expenditure, and looked at the environmental effect; the results of the modelling effort provided below are meant to provide some feel for the financial magnitude of the overall undertaking, and are only an indication, not a prediction. The Secretariat established some simple indicators to compare the different options for recovery of CFC from refrigerators, by relating the costs of each solution to the environmental impact in terms of both ODS and GWP. The results of the modelling undertaken on the above basis and the resulting indicators are shown in the below table.

Table 1: Key data on three options of CFC recovery

Options		**CFC-12 recovery-only**	**CFC-12 recovery and oil-treatment**	**CFC-11 recovery**
ODS recovered [ODP tonnes], total		38.1	79.5	304
ODS recovered [ODP tonnes], average per year		3.81	7.95	30.4
Climate impact [tonnes of CO_2 equiv], total		415,290	866,550	1,447,680
Max. eligible project costs (assuming 2 years) [US $]		100,600	209,880	797,280
Aggregated cost [US $]		961,000	2.13 million	15.34 million
Aggregated income [US $]		2.32 million	4.85 million	12.98 million
Aggregated profits (taking into account possible MLF funding) [US $]		1.37 million	2.93 million	-1.57 million
Capital needed from e.g. the facility to ensure liquidity (taking into account MLF funding) [US $]		75,000	410,000	7.5 million
Indicators				
Cost effectiveness [US $/one-time kg ODS emission reduction] [3]	MLF funding only	13.2	13.2	13.2
	Total cost	25.2	26.8	50.5
Total cost vs. climate impact ("climate cost effectiveness") [US $/tonne CO_2 phase-out]		2.31	2.46	10.60
Liquidity needed	Per kg ODS phase-out [US $]	1.97	5.16	24.67
	Per tonne CO_2 phase-out [US $]	0.18	0.47	5.18
Funding shortfall		No	No	Yes

[3] In the Multilateral Fund, cost effectiveness figures have been defined on the basis of reduction in annual consumption, i.e. the annual consumption would for every year in the future be lower by the tonnage replaced in a project ("sustained aggregate reduction"). In terms of actual amount of ODS not consumed, the saving is recurring every year, i.e. ideally every year after completion of a project the consumption is lower than before by the margin phased out in the project. The impact on the environment is, therefore, an aggregated number being a multiple of the tonnes of annual consumption phased out. To assess the absolute impact of a project on the ozone layer, one could multiply the cost effectiveness by a factor of, e.g., ten to reflect that without a project this company would have consumed the quantity of ODS phased out for ten years longer. The destruction of CFC, however, is a one-time effect, and therefore in terms of cost effectiveness about a magnitude lower than consumption sector projects usually are.

(g) The alternatives of CFC-12 recovery-only and CFC-12 recovery and oil-treatment differ largely in the amount of substance extracted, and in the related cost. They have similar cost effectiveness for the ODS emission reduction and for the climate impact. The CFC-12 recovery and oil-treatment needs significantly higher up-front investment, which leads to an accordingly higher need for liquidity. Both projects make profits in this model, which could be used e.g. to process other refrigerants from appliances collected under the overall undertaking in Mexico, *inter alia* HCFC-22 from air conditioners and the increasing amount of HFC-134a from refrigerators. One could also point out that profits indicate that despite potential fluctuations in prices for VER, losses can still be avoided. Since the option of CFC-12 recovery and oil-treatment produces twice the environmental benefit, the Secretariat would suggest further exploring this particular option.

(h) Under the assumptions described above, the CFC-11 recovery is a problematic case in the sense that there is, even with funding through VERs, a very significant shortfall of funds in the order of US $1.57 million. Further, due to high up-front cost the liquidity needs are very high, with an assumed US $7.5 million due to the need to establish a shredding facility up-front. In comparison to both other alternatives, the CFC-11 recovery is very cost-inefficient. Particularly problematic are also the very high up-front investments, which will tie up significant capital. While the profits from, in particular, the CFC-12 recovery and oil-treatment option might be sufficient to cover the losses of the CFC-11 recovery, the necessary liquidity still has to be provided for a number of years, and there is no room for any volatility in the prices of VERs. This, in the view of the Secretariat is a major problem that resulted in the Secretariat advising UNIDO not to concentrate on the CFC-11 recovery option.

(i) The Secretariat undertook a number of parameter variations to understand under which circumstances a break even can be achieved for the case of CFC-11 recovery. Evidently, lower assumed cost for the shredding will result in lower overall cost, but the model already assumed cost substantially lower than literature data suggests. While the Secretariat will continue to collect data and adjust its model as necessary, it is unlikely that the destruction cost per refrigerator will drop to a degree where CFC-11 recovery becomes profitable. This becomes clear if one looks at some simplified underlying economics: The amount of 288g of CFC-11 recovered from one refrigerator is equivalent to 1365 kg of CO_2; at the current income of US $5.6 for CAR VERs (i.e. market price of US $7) per 1000 kg of CO_2, the income per refrigerator will be US $7.64. Even without taking into account further cost such as administration, verification etc., the recovery of the CFC-11 will lead to costs of US $10 per refrigerator, and its transport and destruction will add a further US $2 to this amount. This simplified approach already leads to a necessary carbon-price of US $11 or more to break even, or a reduction in costs for CFC-11 recovery to less than US $5 per refrigerator; this does not take into account a number of additional costs and yield-reducing factors, which would reduce the economic attractiveness further. Taking into account a number of other costs and risks, the changes in cost for CFC-11 recovery and/or the CAR VERs have to be even more significant.

(j) On the basis of currently available information as presented above, it appears that the recovery of CFC-11 from refrigerators will, for the foreseeable future, depend on additional funding beyond VERs or availability of disassembly sites; this funding will need to go well beyond providing liquidity for the start-up phase until income from carbon credits are being realised. Using the above figures, it appears that the necessary subsidy will be in the order of US $4.36 per refrigerator or US $15 per kg of CFC-11. In reality this figure will be higher in order to account for risk, administration and other costs. The subsidy would be in addition to providing the necessary liquidity for bridging the time until income from sold VERs can pay for the operating cost.

10. On the basis of the above modelling, the Secretariat advised UNIDO to reformulate the project. The eligibility under the existing guidelines only allows funding of the storage, transport and destruction of ODS, not for collection and removing CFCs from refrigerators falls under the category of "collection". While funding for storage, transport and destruction improves further the viability of the overall undertaking, the model shows that significant cash shortfalls of several hundred thousand dollars will take place during the first two years of operation. Realising this, the Secretariat suggested to UNIDO that Mexico could request funding from the special funding facility to cover for the cash shortfalls and return the funds in case of sufficient operating profits, including a risk premium. UNIDO indicated to be interested to explore this way forward further.

11. There are a number of additional questions the Secretariat raised with UNIDO, among them the status of the collection of refrigerators in Mexico and of the legal situation in the country; this information is essential in order to understand whether the project complies with the existing guidelines and whether the quantities assumed to be collected are indeed realistic, which has a direct impact on the viability of the project. Other issues include the possibility to include the destruction of unusable halon from halon-recycling in the project, and whether the ownership of existing stocks of CFC-12 allows that they are destroyed under this project, generating through the selling of VERs funding for further work. These discussions and the associated review of material provided are ongoing at the time of writing of this document. The Secretariat will inform the Executive Committee of the progress achieved.

12. At this point in time the Secretariat would appreciate if the Executive Committee could indicate, through a decision as suggested below, whether the direction suggested by the Secretariat is acceptable.

RECOMMENDATION

13. The Executive Committee might wish to consider:

(a) Noting the submission by Mexico of a project for the disposal of CFC-12 refrigerant from domestic refrigerators; and

(b) Requesting the Secretariat, when further reviewing this project:

(i) To take into account the possibility of using the special funding facility to fund activities not eligible under the Multilateral Fund for the collection of ODS, and bridge the time lag between the expenditures for refrigerant recovery and the availability of income from carbon credits;

(ii) To arrange that any funding provided by the special funding facility for this project is subsequently recovered through returns from annual operating profits, including an adequate risk and administration premium; and

(iii) To provide that these returns are to be paid only when the recovery operation shows an annual operating profit, and should be limited to an adequate share of those profits.

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