



**United Nations
Environment
Programme**



Distr.
LIMITED

UNEP/OzL.Pro/ExCom/24/40
7 March 1998

ORIGINAL: ENGLISH

EXECUTIVE COMMITTEE OF
THE MULTILATERAL FUND FOR THE
IMPLEMENTATION OF THE MONTREAL PROTOCOL
Twenty-fourth Meeting
Montreal, 25-27 March 1998

INCREMENTAL OPERATING COSTS FOR COMPRESSORS

Background

1. Decision 22/26 provides guidelines for the calculation of incremental operating costs (IOC) associated with the supply of non-ODS compressors in the refrigeration sector¹. In the decision the Executive Committee requested the Fund Secretariat to undertake additional work on several issues relating to its implementation.
2. Decision 23/12 requested the Fund Secretariat together with the implementing agencies to produce a document to differentiate between the domestic and commercial refrigeration sub-sectors as well as between the domestic and commercial application of compressors. The decision also requested the Secretariat and the implementing agencies to agree to a specific methodology for determining what incremental costs will be used for defining the eligible costs (as required by Decision 22/26).
3. Decision 23/13 inter-alia requested the Secretariat together with the implementing agencies, to prepare a document on a methodology for establishing compressor prices (also required by Decision 22/26).

Methodology for implementation of the main principles of the of the guidelines, paragraphs (a), (b) and (c) of Decision 22/26.

4. The calculations proposed to be used to implement the guidelines are presented in full in Annex II. As required by paragraphs (a) and (b) of the guidelines, countries which do not produce compressors or are not seeking compressor manufacture conversion costs may receive 100 percent of compressor IOC for loaded non-CFC compressors calculated in the same way as has occurred in previous projects. Countries which produced more compressors than refrigerators in 1995 and are seeking compressor manufacture conversion costs will not receive any compressor IOC. On the basis of the example given in paragraph (c) of the guidelines, the eligible IOC payable to downstream users in countries which have received or intend to seek funding for compressor conversion are calculated as a proportion of the IOC payable if compressor conversion was not being funded.
5. Decision 22/26 does not take into account the situation where a country has received compensation both for compressor conversion and for compressor IOC associated with downstream users. To maintain equity between countries and to prevent double counting when implementing paragraph (c) of the guidelines, it is necessary to account for compressor IOC already received. This has been included in the calculations in paragraph (6) of Annex II.

Alternative methodology for adjusting the level of compensation to account for compressor conversions previously funded, paragraph (d) of the guidelines.

6. As required by paragraph (d) of the guidelines, the calculations provide an alternative approach in cases where a country has received compensation for some of its compressor manufacturers but for the rest would like instead to receive compensation for its downstream users. After ascertaining that the number of compressor conversions funded is less than the 1995

¹ The text of the decision is appended in Annex I.

production of refrigerators, the alternative approach subtracts from the IOC calculation for each downstream enterprise a calculated proportion of the total compensation from the Multilateral Fund previously paid to the country for compressor conversions.

7. Again, the calculations avoid double counting at the country level by accounting for the compensation paid to downstream users funded before the country opted to use the alternative methodology (see paragraphs (8) and (9) of Annex II).

Countries where downstream users have been converted first.

8. The guidelines address the situation where an Article-5 country first converts its compressor manufacturers then converts its downstream users. Some Article-5 countries have converted downstream users first, but may subsequently wish to seek funding for conversion of their compressor manufacturers. Confirmation is sought from the Executive Committee that the principles in the guidelines will apply.

9. Thus, where a country had already received IOC for compressors for a greater number of downstream units than the number of compressors manufactured in 1995, capital costs for compressor conversion would not be eligible (as in paragraph (b) of the guidelines). Where a country had received compressor IOC for some of its downstream users but wished in the future to receive compensation for the capital cost of conversion of its compressor manufacturers, the level of compensation would be reduced, either on the basis of the example in paragraph (b) of the guidelines or, at the option of the article-5 country concerned, by offsetting the compensation previously paid to downstream users for compressor IOC, in a distributive manner (as in paragraph (d) of the guidelines).

Treatment of import and export of compressors.

10. Paragraph (a) of the guidelines provides that downstream manufacturers will continue to be eligible for compressor incremental operating costs *unless such compressors are being procured from firms that the Fund is paying to convert*. In this case, for compressor manufacturing countries, the 1995 compressor production numbers provided in accordance with paragraph (b) of the guidelines may need to *exclude* the numbers manufactured for export, because those compressors are not available for inclusion in refrigerators manufactured in the country. This can lead to difficulties in verification of compressor numbers, both in relation to numbers exported and, for downstream manufacturers in compressor importing countries, in relation to the numbers imported from firms the Fund has paid to convert.

11. There are a total of three possible options for dealing with exports:

- (a) The above situation, reflecting the decision as it stands;

- (b) To ignore the numbers of compressors exported when providing information on compressor numbers produced in a country, but at the same time, to agree to pay IOC to the downstream user in the importing country irrespective of whether the Fund has paid the supplier to convert;
 - this could result in additional costs to the Fund if an exporting country produced more compressors than downstream refrigerators;
- (c) To pay IOC to both the downstream users in the exporting country and the importing country, but to discount the capital costs for future compressor conversions, proportionately, for the numbers of compressors exported to Article-5 countries (in addition to exports to non-Article-5 countries);
 - this would remove the need to account for export and import numbers in calculating eligible IOC for downstream users.

12. Advice is requested from the Executive Committee as to how the numbers of compressors exported and imported might be treated.

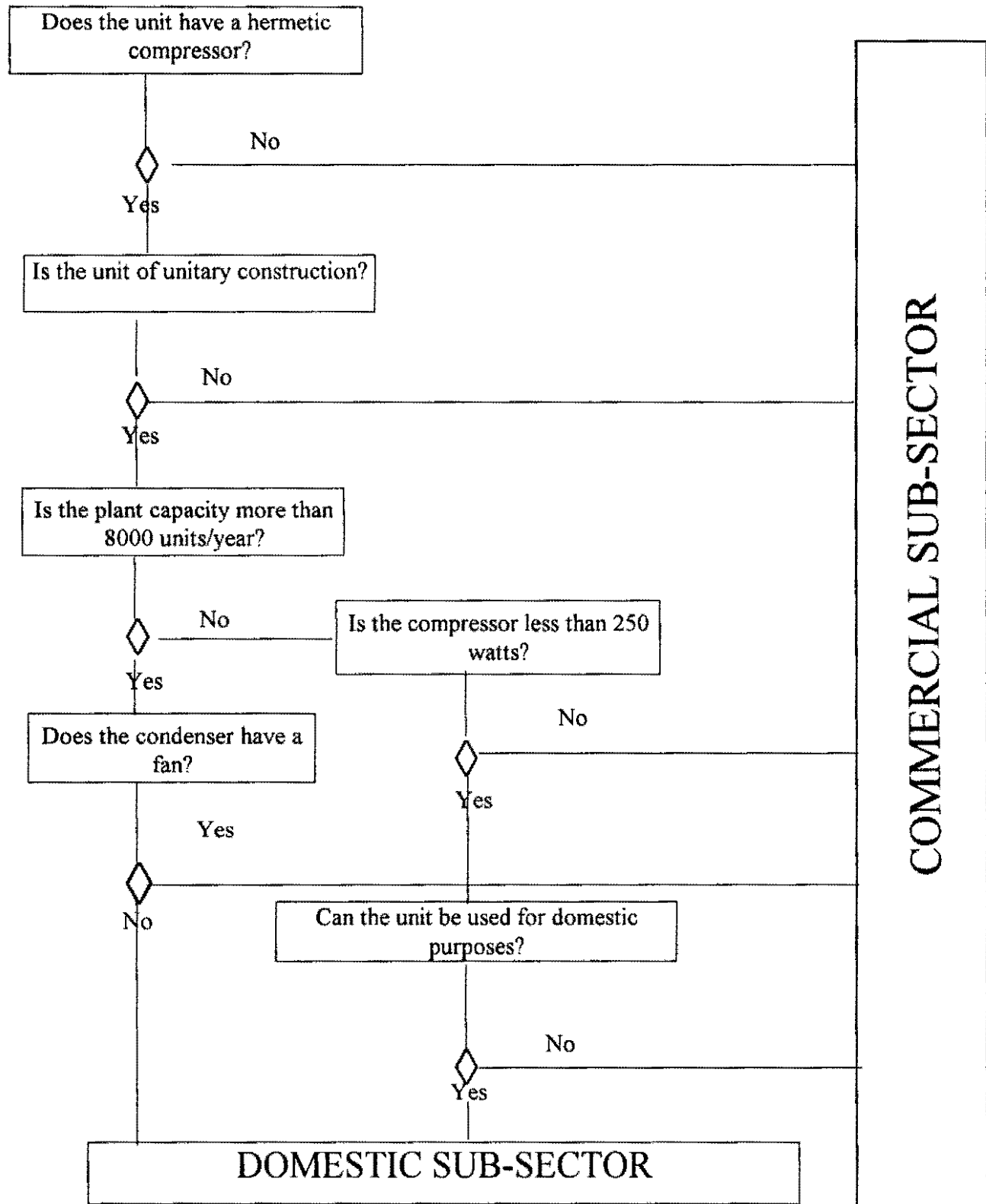
A methodology to differentiate between the domestic and commercial sub-sectors and the domestic and commercial applications of compressors

Domestic and commercial sub-sectors

13. Following consultation between refrigeration experts, implementing agencies and the Fund Secretariat, it is proposed that the boundary between the domestic and commercial refrigeration sub-sectors be determined in the basis of the *decision diagram* presented in Figure A as follows:

Figure A

Decision Diagram to Differentiate between the Domestic and Commercial Refrigeration Sub-sectors



14. The diagram indicates whether the refrigerators, freezers or other refrigeration units such as water coolers produced by a downstream manufacturer should be classified as being in the domestic or commercial subsectors, for the purposes of applying Executive Committee rules and policies, including those contained in Decision 22/26. The diagram is used by commencing at the top and answering, in sequence, the six factual questions relating to the description of the refrigeration unit being produced and the manufacturer of the equipment. The questions are drawn from the general characteristics of refrigeration units in each of the two sub-sectors (presented in full in Annex III) and were selected to provide a decision diagram which would give accurate results but which would not be too complicated to use. The result produced by the decision diagram for any particular item of refrigeration equipment will meet the various criteria listed in Annex III.

Domestic and commercial application of compressors

15. The Fund Secretariat and the implementing agencies have agreed that the only reliable criterion to differentiate between domestic and commercial application of compressors, when counting the numbers produced for use in each sub-sector, is the compressor size (that is, the power input), because use of this criterion does not require the compressor manufacturer to speculate about the end use of its compressors. Discussions with a wide range of experts have indicated that a compressor size of 250 watts, while not exact, gives an equitable division between sub-sectors. Above 250 watts compressors would be classified as commercial. Below 250 watts compressors would be classified as domestic.

16. For instance, all non-hermetic compressors are greater than 250 watts and are thus correctly classified as commercial. Hermetic compressors of various sizes can be produced by the same manufacturer for both domestic commercial end-use. Hermetic compressors of greater than 250 watts are predominantly used in the commercial sub-sector. Hermetic compressors of less than 250 watts are produced in very large numbers and are predominantly used in units which meet the criteria for the domestic sub-sector.

A methodology for determining what incremental cost will be used for defining the eligible costs, paragraph (e) (iv) of Decision 22/26.

17. Paragraphs (a) and (d) of Decision 22/26 state that incremental operating costs for *loaded non-CFC compressors* would continue to be eligible as pertinent. This is because the most clearly identifiable additional cost arising from the use of a non-CFC compressor is the cost associated with the new synthetic oil needed for use with HFC-134a refrigerant. When the compressor is supplied by the compressor manufacturer to the refrigerator manufacturer with the required oil already installed, the compressor is described as "loaded".

18. The terms of Decision 22/26 provide that incremental operating costs will no longer be paid to compressor manufacturers. Any incremental operating costs associated with non-CFC compressors will be paid to the downstream user. When costs were paid to the manufacturers, it was necessary to define the eligible cost components in order to calculate the additional cost of producing a non-CFC compressor. For compressors used by downstream manufacturers the

incremental operating costs will be based on the compressor price. A methodology for determining compressor prices is presented later in this paper.

19. It is necessary to specify the methodology to be applied when compressors which do not contain oil (i.e. "dry" compressors) are purchased. In this case the compressor IOC would be based on the market price of a dry compressor. The refrigerator manufacturer could also be eligible for the capital cost of new equipment needed to fill the compressors with oil and the incremental operating cost of the oil supplied in bulk, up to a limit of cost equivalent to the difference in IOC between loaded and dry compressors.

Combined refrigerator and compressor manufacturers

20. If a country has received compensation of some of its compressor manufacturers, paragraph (d) of Decision 22/26 provides the option for a country to elect, for the remainder of its firms, to receive compensation for downstream users. However, the country will need to decide, before submitting any new refrigeration project proposals involving incremental operating costs, whether it wished to seek compensation for compressor conversion, or instead seek compressor IOC for downstream users. The selected option would then have to be followed in determining compensation for all the remaining enterprises in the sector.

21. By including sub-paragraph (e)(v) in Decision 22/26, the Executive Committee provided an opportunity for additional consideration to be given to the situation of combined refrigerator and compressor manufacturers. If pursued, this consideration might involve permitting combined manufacturers in a country to be compensated for the compressor conversion option, while the downstream manufacturers which did not have compressor manufacturing facilities were compensated under the other option.

22. Analysis undertaken by the Secretariat indicates that in some circumstances the level of compensation received by downstream manufacturers in a country could be increased by up to a factor of three if combined plants are treated separately. The additional compensation would not go to the combined plants. Rather, it would go to the downstream manufacturers which did not have their own compressor production facilities. This would occur because, with the combined plants treated separately, the group comprising the other downstream manufacturers would not have been compensated previously for compressor conversion and thus would receive full eligible compensation for compressor IOC.

23. Relevant issues which arise from possible separate consideration of combined plants are:

- if a country is unable to achieve a consensus among its manufacturers as to the preferred option, it will be unable to move ahead on incremental operating costs associated with compressors, because it is required by the terms of Decision 22/26 to decide in advance the option it wishes to pursue for the country as a whole: that is, for all its enterprises;
- in a country with a high proportion of combined plants, those enterprises which are not combined plants will be disadvantaged because their IOC for downstream users may be

reduced to account for compensation for the conversion of compressors to which they may not have access;

- if combined plants are not treated separately, they might be eligible for both compensation for compressor conversion, and for a proportion of compressor IOC (since the country as a whole might not be fully compensated for compressor conversions);
- overall compensation to a country for compressor IOC may increase if combined plants are treated separately to the remainder of the sector;
- the Multilateral Fund normally deals with countries not enterprises;
- equity considerations suggest that combined plants should be subject to the same policies as the other enterprises in a country, and *vice-versa*;
- in practice, few enterprises will operate as 100 percent combined plants: the actual source and destination of compressors will vary over time according to prevailing economic circumstances and business arrangements, and would be difficult to verify;
- identification of combined plants might not be straightforward:
 - could enterprises in separate regions of a country, separately managed, but under the same corporate ownership, be classified as a combined plant?
 - ownership can change rapidly: in particular, in several cases ownership has changed between 1995 (the date for reporting of production numbers) and the present time.

24. The Executive Committee is invited to consider these issues and provide guidance as to whether it wishes to give special consideration to the guidelines as they might apply to combined plants. This could involve agreeing that compensation for the enterprises would be based on the numbers of compressors produced and used in group of combined plants, without reference to the overall situation in the country. Alternatively the Committee could conclude that the guidelines as formulated in Decision 22/26 should apply to the country as a whole.

A methodology for establishing compressor prices

25. Incremental operating costs are calculated for each compressor on the basis of the market price, using the arithmetic model in Annex II to apply the various conditions included in Decision 22/26. The total incremental operating cost for the enterprise is calculated by multiplying the cost per compressor by the level of production of the enterprise determined according to the rules of the Multilateral Fund. Since annual production levels for larger enterprises can be between 500,000 and 1 million units, variations of even US \$1.00 per compressor can make very significant differences to the overall level of compensation eligible for payment. It is therefore important to establish an equitable and credible methodology for establishing the market price of compressors.

26. This methodology has been developed principally to examine the prices of small hermetic compressors as it is this type of compressor that is used in large quantities. The methodology can be applied to larger hermetic compressors but may need to be reexamined in relation to non-hermetic compressors used in large commercial refrigeration systems as these compressors have not yet appeared in large numbers in Multilateral Fund projects.

27. To establish a range of market prices for use in formulation and assessment of project, it is necessary to:

- different manufacturers can supply similar compressors of different qualities (and thus different prices) define compressors in terms of both capacity and quality
- establish how the prices vary with the quantity being purchased;
- establish the market prices for different models in different regions for loaded and dry compressors
 - using FOB and CIF prices as appropriate;
 - taking in to account local taxes and levies
- provide sufficient information in projects to ensure that the replacement compressors are costed on the basis of equivalent purchase numbers and equivalent quality.

Definition of capacity and quality

28. There are a relatively small number of manufacturers of hermetic compressors (including those in Article-5 countries). It is proposed to engage an industry specialist to provide advice on classifying the manufacturers into groups which can be compared on the basis of quality and price for compressors of comparable size. This will only need to be done once, with the option of updating if manufacturing conditions change. It is possible that about three equivalent quality groups would be established for both CFC and non-CFC compressors. Costs would be eligible for replacement compressors from the same quality group but not for compressors in a higher quality group.

Volume discounts

29. The unit price of ten compressors bought for test purposes will be different from the unit price of 100,000 of the same compressors. The expert consultant will be asked to establish the relationship between the number of compressors purchased and the unit cost. Subject to the consultants advice, this research should only have to be undertaken once. The results can be applied in assessment of costs for both CFC and non-CFC compressors in individual projects.

Market Prices

30. Market prices for the major manufacturers of compressors need to be established, then updated on an annual basis during the last quarter of each calendar year for use in projects submitted during the following year. Initially, prices can be established by using an expert consulting organization with established contacts in the compressor manufacturing industry. The consultant should provide costs for each relevant compressor size from each manufacturer on a regional basis for both CFC-compressors and the loaded and dry non ODS equivalent, using CIF

or FOB prices as appropriate, excluding local levies and taxes. The consultant's study would be managed by the Fund Secretariat. For subsequent years the consultant should undertake an update to establish the movement in price for representative compressor types, and representative geographic regions.

31. Additionally, some 200 investment projects in the refrigeration sector have been approved. Over 30 have now been listed in the inventory of approved projects as having been completed. Actual prices should be provided by the implementing agencies for both CFC compressors and non-ODS replacement compressors.

32. These actual prices could be used to verify the figures obtained from the market surveys.

Prices to be used in Projects

33. Projects submitted during the year would use the prices established in the consultant's study for that year. Prices must be based on non-CFC compressors of equivalent quality and purchased in equivalent numbers to those used in an enterprise's baseline.

ANNEX I**(Decision 22/26)****Incremental operating costs for compressors**

Having considered the recommendations of the Sub-Committee on Project Review on incremental operating costs for compressors (UNEP/OzL.Pro/ExCom/22/15, paras. 25-26), the Executive Committee decided that:

- (a) In countries that do not have compressor manufacturers, or have undertaken not to seek funding for conversion of any compressor manufacturers, incremental operating costs for loaded non-CFC compressors would continue to be eligible for compensation unless such compressors are being procured from firms that the Fund is paying to convert;
- (b) For countries that are seeking funding for conversion of a compressor manufacturer, in order to be eligible for incremental operational costs, they must first submit information on their 1995 production of compressors and downstream user products. If those data show that compressor production was equal to or greater than the production of the downstream equipment producers, no funds shall be provided for incremental operational costs associated with the compressors;
- (c) For countries that are seeking funding for conversion of compressor manufacturers that produced less than the number of units produced by the downstream users, the eligible incremental operational costs associated with compressors for downstream users shall be reduced in accordance with the following example: if a country produced 100 refrigerators, but is seeking compensation for the production of 90 compressors, the eligible incremental costs for the downstream users would be 10 per cent of the level otherwise eligible for funding in a distributive manner;
- (d) If a country has received compensation for the conversion of some of its compressor manufacturers, but for the remainder of its firms would like instead to receive compensation for its downstream users, such compensation for the downstream users for the cost of loaded compressors would be eligible - however, the level of compensation would have to be adjusted using, at the choice of the country, either the example used above, or in a manner (to be proposed by the Secretariat and the Implementing Agencies for the consideration of the Executive Committee) which would offset funds spent on the earlier conversion projects in a distributive manner;

- (e) The above guidelines were adopted with the following understandings:
- (i) Incremental operating costs will no longer be considered for compressor manufacturers;
 - (ii) The guidelines will independently apply to domestic and commercial refrigeration projects;
 - (iii) Further work may need to be done to accurately define domestic and commercial refrigeration;
 - (iv) The agencies and the Secretariat need to agree to a specific methodology for determining what incremental cost will be used for defining the eligible costs;
 - (v) Further work needs to be done in relation to combined compressor and refrigerator manufacturers;
 - (vi) In considering the availability of domestic compressor production within Article 5 countries, one factor which may be considered by the Secretariat and the Implementing Agencies could be the source of supply used by the downstream users in the baseline;
 - (vii) Given the apparent ambiguity that existed prior to this meeting regarding the eligibility of incremental operational costs for domestic refrigerator compressors, projects submitted to the Twentieth and Twenty-first Meeting will be approved with operational costs as agreed between the Implementing Agencies and the Secretariat;
 - (viii) Domestic refrigeration compressor projects first submitted to this Meeting, one Meeting after the issue was originally raised, shall be agreed consistent with the above guidelines;
 - (ix) Projects submitted to the present Meeting in the commercial refrigeration sector (where this issue was first raised) shall be decided consistent with the manner in which previous projects were approved;
 - (x) After the present Meeting, all compressor projects shall be considered in accordance with the above guidelines.

(Decision 22/26)

ANNEX II

Model for Calculating Incremental Operation Costs (IOC) for Compressors in Domestic and Commercial Refrigeration Projects

1. This model is for the specific categories of Article 5 countries and cases as outlined in Decision 22/26. The model should be applied separately for calculating IOC in the domestic and commercial refrigeration sub-sectors.

Category A: Article 5 countries which do not have compressor manufacturers or have undertaken not to seek funding for conversion of their compressor manufacturers are eligible to receive incremental operational costs for loaded non CFC-Compressors. (paragraph 44 (a)).

2. IOC are calculated in the same way as in the past.

$$\text{IOC} = r * t * i$$

where

IOC = incremental operating cost for compressors (US\$)

r = eligible annual production of the enterprise (units/year)

t = IOC duration

i = incremental cost per loaded or unloaded compressor (US\$/unit)

Category B: Article 5 countries which have compressor manufacturers and which have received or are seeking funding for conversion of their compressor manufacturers (paragraphs 44 (b), (c)).

Step 1: Determination of eligibility of Article 5 country for IOC

3. In order to determine the eligibility of an Article 5 for funding IOC and the applicability of Paragraph 44 (c) to it, the 1995 level of production of compressor and downstream refrigeration equipment should be provided separately for domestic and commercial sub-sectors countrywide according to the following format:

Table 1: 1995 Compressor production

Sub-Sector	No. of units per year		
	Hermetic < 250 Wt	Hermetic >250 Wt	Semi-Open Drive >250 Wt
Domestic compressors	C1	0	0
Commercial compressors	0	C2	C3

Table 2: 1995 Refrigeration equipment production

Sub-Sector	No. of Units per year
Domestic appliances	R1
Commercial equipment	R2

4. If the total 1995 compressor production was equal to or greater than downstream production of domestic and/or commercial refrigeration equipment no IOC shall be funded. (No IOC will be paid if $C1 \geq R1$ and $C2+C3 \geq R2$).

5. If the number of compressors produced is less than the number of units produced by downstream users an Article 5 country is eligible for IOC funding. (IOC will be paid if $C1 < R1$ and $C2+C3 < R2$).

Step 2: Calculation of IOC

6. IOC for compressors for a particular enterprise can be calculated in this case in a distributive manner as follows:

$$IOC = cf * r * t * i$$

where

cf is a funding coefficient = $(R-C-Rf)/R \times (1+Rf/(R-Rf))$

R = total number of downstream units produced by the country in 1995 (units)

C = total number of compressors produced by the country in 1995 (units/year)

Rf = cumulative annual production of downstream units for which IOC have been funded by the Multilateral Fund. (units/year)

- (Note: (1) if "cf" is zero or negative, IOC are not eligible)
 (2) if an Article 5 country did not receive any funding for IOC from the Multilateral Fund, the $Rf=0$ and the funding co-efficient will be $R-C/R$.

r = eligible annual production of the enterprise at the time of the project (units/year)

t = IOC duration

i = incremental cost per loaded or unloaded compressor (US\$/unit)

Category C: Article 5 countries which have received compensation for the conversion of some of their compressor manufacturers, but for the remainder of its firms would like instead to receive compensation for downstream users (Paragraph 44 (d) of Decision 12/26).

7. The country has two options in order to receive compensation for downstream users.

8. Option 1: Compensation is calculated using the same approach as in paragraph 6 above.

$$IOC = pf * r * t * i$$

pf is a funding coefficient = $(P-A-Rf)p \times (1+Rf/(p-Rf))$

Where

P = total current annual production of downstream products (units/year)

A = total annual production of compressors for which the country has received funding for conversion (units/year)

Rf = annual production of downstream units for which IOC have been funded by the Multilateral Fund (units/year)

(Note: (1) if “ pf ” is zero or negative, IOC are not eligible
(2) if an Article 5 country did not receive any funding for IOC from the Multilateral Fund, the $Rf=0$ and the funding co-efficient will be $(P-A)/P$.

r = eligible annual production of the enterprise at the time of the project (units/year)

t = IOC duration

i = incremental unit cost per loaded or unloaded compressor (US\$/unit)

9. Option 2: Compensation is calculated to offset funds spent on earlier (compressor) conversion projects in a distributive manner.

$$IOC = (r * t * i) - (ICf + IRf) * \tau/R$$

Where,

r = eligible annual production of the enterprise at the time of the project (units/year)

t = IOC duration

i = incremental unit cost per loaded or unloaded compressor (US\$/unit)

ICf = the total compensation received by an Article 5 country for conversion of some of its compressor manufacturers (US\$)

IRf = the total compensation received by end users in Article 5 country for incremental operating costs associated with compressors (US\$)

R = the total current production of downstream products in the Article 5 country (units/year)

Note: $(ICf + IRf) * r/R$ represents a prorated share of the total compensation received by a given Article 5 country, which must be deducted from the IOC otherwise payable to the enterprise.)

10. For the purposes of demonstrating the above calculations, the numbers of compressors and refrigerators used do not account for import and export.

ANNEX III

GENERAL CHARACTERISTICS OF REFRIGERATION UNITS IN THE DOMESTIC AND COMMERCIAL SUB-SECTORS

Characteristics which apply to the domestic sub-sector:

- uses only hermetic compressors
- compressor input power predominantly below 250 watts.
- refrigerators/freezers are of unitary construction (that is the compressor is in the refrigerator/freezer, not located elsewhere)
- condensers do not have fan-forced airflow
- units are manufactured predominantly in automated production lines using foam injection.
- total production capacity is usually above 8000 per year (about 30 per day)
- some units meeting the above criteria are used in commercial applications for food/merchandise storage.

Characteristics which apply to the commercial sub-sector:

- uses both non-hermetic and hermetic compressors
 - all units with non-hermetic compressors are commercial
- hermetic compressors are predominantly (but not exclusively) greater than 250 watts
- uses both non-unitary and unitary construction
 - all non-unitary units are commercial
- small units may be of unitary construction
- evaporators and condensers predominantly have fan-forced airflow
- units are predominantly manufactured in manual operations with manual foaming or pre-manufactured foam sheets
- total production capacity is predominantly less than 8000 units per year
- virtually all small units are used in 'commercial' applications for food/merchandise storage.

Characteristics which apply to both sub-sectors:

- equipment of unitary construction using small hermetic compressors can be both domestic and commercial
- equipment can have dual end-use, e.g. small freezers can be used for domestic purposes and for commercial food/merchandise storage.