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Item 10 of the provisional agenda[1]

REPORT ON END-USER INCENTIVE SCHEMES FUNDED UNDER THE APPROVED HCFC PHASE-OUT MANAGEMENT PLANS (decision 84/84(e))

Introduction

1. The guidelines for end-user[2] conversion in the commercial refrigeration sector adopted by the Executive Committee at its 28th meeting (decision 28/44), established the relevant circumstances[3] that had to prevail before priority would be accorded to end-user conversion activities.

2. Subsequently, the concept of incentive programmes for the retrofits of refrigeration equipment by commercial and industrial end-users was developed at the 32nd meeting. The proposals involved a scheme through which enterprises ready to phase out the use of CFCs in their refrigeration systems, either by refrigerant replacement or by retrofitting, could apply for an incentive grant on a first-come, first-served basis. The Executive Committee decided that these projects could be submitted on the understanding that *inter alia* the timing of the proposed activity was appropriate for the country's circumstances (decision 32/28).

3. Several evaluations referred to the end-user incentive programmes, suggesting that they could, in principle, be effective if certain prerequisites were put in place, without which the necessary cooperation with the potential beneficiaries would be very difficult or impossible to realize. Another conclusion of the

[1] UNEP/OzL.Pro/ExCom/92/1

[2] In Multilateral Fund terminology, refrigeration and air-conditioning end-users are the final customers owning and operating systems containing controlled substances. They range from individuals owning a refrigerator or an air conditioner to commercial and industrial businesses operating a wide variety of systems of different types, sizes and capacities as part of their production process, storage, or air-conditioning.

[3] That is, an operational and effective import licensing system with quota allocations, a reliable control of the level of CFC consumption, a narrowing or even inverted price differential between CFCs and alternative refrigerants, the introduction of economic incentives to industrial and commercial enterprises, and economic growth which helped to mobilize public and private funds for modernization of investments.

evaluations was that end-user incentive projects worked well in places where CFC-12 prices were rising rapidly while the prices of equally available alternatives were stable.[4]

4. At its 80th and 81st meetings, in considering tranche requests of stages I of HCFC phase-out management plans (HPMPs), the Executive Committee raised concerns regarding the implementation of end-user incentive schemes to promote the conversion of refrigeration and air-conditioning (RAC) systems to HCFC alternatives. These concerns included the lack of strong commitment from the governments and/or end-users to support the adoption of selected alternative technologies with low global-warming potential (GWP), the lack of co-financing required to pay for the conversions, the lack of training associated with the conversions, and the consequent lack of sustainability. As a result, the Committee approved the funding tranches on the understanding that, *inter alia*, training of servicing technicians would enhance the sustainability of the end-user incentive programmes, and that end-users would provide co-financing to participate in the scheme.

5. At its 82nd meeting, the Executive Committee removed from the list of projects submitted for blanket approval, tranche requests of HPMPs that were experiencing difficulties with respect to end-user incentive schemes. Subsequent to a discussion on this matter, the Committee requested the Secretariat to compile information on end-user incentive schemes (also referred to in the decision as, *inter alia*, demonstrations, pilot projects, and incentive programmes) funded under the approved HPMPs, and to submit a report including detailed information on the approved activities, including tonnage to be phased out, funding, co-funding to be provided, number of beneficiaries, sector, and associated technical assistance; status of schemes, including information on delays, if relevant; and decisions of the Executive Committee relevant to end-user conversions as they pertained to the incentive schemes approved under the HPMPs (decision 82/54).

6. At the 84th meeting, the Executive Committee considered the report on end-user incentive schemes funded under the approved HPMPs,[5] prepared by the Secretariat in line with decision 82/54, and decided *inter alia* to consider time-limited and one-off demonstration and pilot projects addressing end-users on a case-by-case basis, taking into consideration the circumstances that had to prevail before projects could be directed to end-users, consistent with the guidelines contained in decision 28/44 for end-user conversion in the commercial refrigeration sector.

7. Decision 84/84(e) further requested the Secretariat to provide an updated report to the first meeting of 2023 to reassess the effectiveness of the demonstration and pilot projects directed to end-users, including updated project results, the cost-effectiveness analysis, discussion of the impact of the decision on such projects, and other observations.

8. Accordingly, the Secretariat has prepared the present document, comprising the following sections:

I. Updated information on the implementation of projects related to end-users

II. Lessons learned from the end-user incentive schemes and demonstration projects

III. Secretariat's observations

IV. Recommendation

9. A summary of data collected across the end-user-related projects is presented in the Annex.

10. This document constitutes an update on the analysis of end-user incentive schemes previously provided in document UNEP/OzL.Pro/ExCom/84/63. The Secretariat gathered additional information on

[4] UNEP/OzL.Pro/ExCom/52/18 and UNEP/OzL.Pro/ExCom/58/8
[5] UNEP/OzL.Pro/ExCom/84/63

relevant projects from the stages and tranches of HPMPs approved since the 84th meeting and updated the reporting template used by the bilateral and implementing agencies to report on progress and lessons learned by including the information requested by decision 84/84(e). In September 2022, the updated template was distributed to bilateral and implementing agencies, who were asked to report on the status of completed and ongoing projects, as well as the progress of projects approved after the 84th meeting.

11. Detailed information collected from the majority of approved projects[6] has been summarized in the Annex to the present document. Examples of reports provided by the bilateral and implementing agencies may be provided upon request. The Secretariat analysed the information provided by the bilateral and implementing agencies, had follow-up discussions, and requested additional feedback during the Inter-agency coordination meeting.[7] The Secretariat appreciated the input and information shared by the agencies.

I. Updated information on the implementation of projects related to end-users

12. The Secretariat has identified a total of 88 activities related to end-users approved by the Executive Committee as of its 91st meeting, including eight activities approved as part of ongoing HPMPs[8] since the previous report submitted at the 84th meeting. Twenty-eight of these have been completed, 20 are ongoing and 40 have been redirected to other activities in the refrigeration servicing sector.[9] A total of nine end-user-related projects submitted for funding as part of HPMP tranches from the 85th meeting[10] have been deferred until it can be demonstrated that the conditions of decision 84/84 have been fulfilled. The summary of identified end-user-related activities, as of the 91st meeting, is shown in table 1.

Table 1. Summary of end-user-related activities approved as part of an HPMP for Article 5 countries

Implementing agency	Number of end-user-related activities				
	Approved	Completed	Ongoing	Redirected (*)	Deferred (**)
UNDP	24	13	3	8	4
UNEP	10	1	1	8	0
UNIDO	39	11	10	18	4
The World Bank	1	0	1	0	0
France	3	0	3	0	0
Germany	11	3	2	6	1
Total	**88**	**28**	**20**	**40**	**9**

(*) The funds were transferred to other activities in the refrigeration servicing sector.
(**) The country may resubmit the proposal under a future tranche upon compliance with decision 84/84.

13. As reported at the 84th meeting, the Secretariat noted that not all projects related to end-users implemented under the HPMPs are end-user incentive schemes for the conversion or replacement of HCFC-based equipment. There are three types of projects being implemented at the end-user level, each with a different purpose and characteristics:

[6] As of 27 April 2023, over 80 per cent of the requested fact sheets had been received.
[7] Montreal, 8-9 March 2023.
[8] For Chile, Ecuador, Guatemala (2), Honduras, Nicaragua, Republic of Moldova, and Venezuela (Bolivarian Republic of).
[9] Due to several factors at the country level, and in light of decisions adopted by the Executive Committee, in particular decisions 72/17, 72/41(c)(iii), and 73/34, end-user conversions were either postponed or redesigned to prioritize other activities in the refrigeration servicing sector (e.g., strengthening the training institutes, additional training programmes on good servicing practices for refrigeration technicians and the provision of additional tools). The reallocations of end-user-related activities have been reported under the relevant tranche progress reports for stages I and II of HPMPs.
[10] For Georgia, Ghana, Guatemala, Honduras, Lesotho, Nicaragua, Nigeria, Peru, and Venezuela (Bolivarian Republic of).

(a) End-user incentive schemes to convert or replace HCFC-based equipment;

(b) Demonstration projects for alternative technologies at end-user installations; and

(c) Leakage reduction programmes at end-users.

14. Table 2 summarizes the projects related to end-users approved by type, status of implementation, and bilateral or implementing agency.

Table 2. Summary of end-user-related projects approved as part of an HPMP for Article 5 countries

Agency	Number of projects by type and status								
	Incentive schemes to convert or replace equipment			Alternative technology demonstrations			Leakage reduction programmes		
	Completed	Ongoing	Total	Completed	Ongoing	Total	Completed	Ongoing	Total
UNDP	9	2	11	4	1	5	-	-	-
UNEP	-	-	-	1	1	2	-	-	-
UNIDO	4	1	5	4	4	8	3	5	8
World Bank	-	-	-	-	-	-	-	1	1
France	-	1	1	-	2	2	-	-	-
Germany	-	1	1	1	1	2	2	-	2
Total	**13**	**5**	**18**	**10**	**9**	**19**	**5**	**6**	**11**

15. The three subsections below provide a description and the main results of each of the three types of end-user-related projects.

I.1 End-user incentive schemes to convert or replace HCFC-based equipment

16. These projects initially consisted of the conversion or replacement of existing HCFC-based equipment by equipment that operates with alternatives.[11] In light of decisions adopted by the Executive Committee in relation to retrofits (decisions 72/17, 72/41(c)(iii), and 73/34), most of the conversions as originally proposed were postponed, or projects were redesigned to prioritize other activities in the refrigeration servicing sector.

17. Therefore, at present these projects mainly consist of equipment replacement predominantly at private end-users and mostly in the room air-conditioning (AC) sector, with part of the funding provided by the beneficiaries. The incentive provided by the Multilateral Fund to cover a portion of the cost varies from 15 to 50 per cent, depending on specific circumstances related to the country, beneficiaries, and application. The demonstration of the new equipment's performance compared to HCFC-based equipment is expected to encourage additional end-users to replace their equipment, and eventually lead to market uptake of the new equipment.

18. Out of the total of 18 end-user incentive projects implemented, 13 have been completed and five are ongoing. Between the 84th and the 91st meetings three countries that were implementing the end-user incentive schemes[12] decided not to pursue them and reallocated the funds to other activities in the refrigeration servicing sector. Their decision was based on difficulty obtaining approval from Government authorities regarding the use of flammable refrigerants, and the lack of end-users' interest in participating due to the low level of the incentive. A summary of the information extracted from the reports submitted by the bilateral and implementing agencies on end-user incentive schemes to convert or replace HCFC-based equipment is presented in table 1 of the Annex to the present document.

[11] For example, providing assistance to replace AC equipment using R-410a with equipment using lower-GWP refrigerants (i.e., HFC-32) to demonstrate their use and encourage market uptake.

[12] Brunei Darussalam, Mozambique, and Timor-Leste.

19. The implementation of the end-user incentive schemes so far has resulted in the conversion or replacement of 1,509 RAC equipment units and a reported phase-out of at least 7.52 metric tonnes (mt) of HCFC-22.[13] All projects were partly funded by the beneficiary end-users, but the amounts paid were not always reported.

20. In addition to the replacement of equipment, reported benefits from the implementation of these projects included: opportunity to showcase new technologies to national stakeholders; reduced use of energy by the new systems; and in some cases the increased availability of the selected alternative technology in the country. Generally, there is limited information on the extent to which other end-users might have replaced their HCFC-based systems with their own funding as a result of these projects, or what influence these replacements might have had on the local market.

I.2 Demonstration projects for alternative technologies

21. These projects usually consist of the conversion or replacement of one or a limited number of refrigeration or AC units operating in a public or private institution with the main purpose of demonstrating the safe use of the low-GWP alternative being proposed (mostly R-290 or carbon dioxide (CO_2)). The Multilateral Fund generally covers either a portion or the total cost of the equipment being converted or replaced and the required technical assistance, and the beneficiary end-user covers costs related to part of the equipment and technical support for installation, maintenance, and monitoring of equipment performance.

22. Out of the 19 projects implemented to demonstrate alternative technologies, 10 have been completed and nine are ongoing. A summary of the information extracted from the reports submitted by the agencies on the demonstration projects for alternative technologies is presented in table 2 of the Annex.

23. The implementation of the demonstration projects completed so far has resulted in the conversion or replacement of 207 RAC systems and a reported phase-out of at least 3.78 mt of HCFC-22.[14] The reported benefits from the implementation of these projects include a better understanding of the capital costs required, applicability of the technology and equipment performance, and potential operational savings that could be achieved; the know-how gained by local enterprises in the application of methods of risk assessment and the operation of systems with flammable refrigerants; reduced use of energy by the new systems (beyond 30 per cent in one case); and the opportunity to showcase new technologies to stakeholders in the countries. Information on the extent to which other end-users have also converted or replaced their HCFC-based systems with their own funding as a result of the projects is limited.

I.3 Leakage reduction programmes at end-users

24. Most of these projects consist of technical assistance for large end-users and are focused on improving containment practices for the existing HCFC-based RAC systems. They include assessment of the condition of the RAC systems; replacement of old and inefficient parts and the use of better seals, valves, pipe connections and other components; recommendations on preventive maintenance procedures to reduce leakages; follow-up visits to monitor implementation and performance; reports containing major findings from the monitoring of the systems, including the cost and financial/environmental benefits of applying the leakage reduction recommendations; and workshops and dissemination of information to other end-users to report on project results, experience collected and recommendations.

[13] The HCFC phased out by the projects was not reported in a consistent manner. In some reports it refers to the refrigerant charge removed from the equipment, while in others it refers to the refrigerant needed for servicing per year, or a combination of both. The actual amount of HCFC phased out is also expected to be larger as not all reports included this figure and there are still projects to be completed.

[14] Refer to footnote #13.

25. Out of the 11 leakage-reduction projects implemented, five have been completed and six are ongoing. A summary of the information extracted from the reports submitted by the agencies on leakage-reduction projects is presented in table 3 of the Annex.

26. The implementation of the leakage-reduction projects completed so far has resulted in annual HCFC-22 leakage rate reductions (of at least 0.80 mt per year, although this figure is expected to be larger as not all projects reported it and not all projects have been completed), improvements in the systems' coefficients of performance, and reductions in energy consumption. The costs associated with the equipment and tools (e.g., leak detectors, vacuum pumps, brazing and other refrigeration equipment assembly accessories), engineering and training were in several cases covered by the Multilateral Fund, while the beneficiary end-user covered technicians' services, consumables and servicing tools. Some replicability has been observed, as the activities have been extended to additional end-users as part of the HPMPs (e.g., Guatemala, Honduras). No information on the level of co-financing provided for these projects has been recorded. These projects have been implemented along with training of technicians.

27. Some of the challenges encountered during the implementation of leakage-reduction projects included the limited availability of components; delays in equipment delivery; and the level of effort required from the national ozone units (NOUs) and the implementing agencies to ensure that suppliers participated in tenders and offered supplies in accordance with the project's technical specifications and requirements (some tenders had to be published several times, delaying the projects).

28. Although the leakage-reduction projects are also addressed to end-users, they differ from the end-user incentive schemes and the technology demonstration projects in that they focus on providing technical assistance to ensure good servicing practices, on reducing refrigerant emissions, and on the proper operation of existing equipment using HCFC-22. Leakage-reduction projects do not involve the replacement or conversion of HCFC-based equipment to low-GWP technologies, which may be hampered by the availability and price of an alternative technology, and by the extent to which existing regulations limit the supply of HCFC-based equipment. For this reason, most of the discussion in this document in relation to the adoption or alternative technologies are not applicable to the leakage-reduction projects. These projects should be considered separately, and in a similar way to any other technical assistance project under the HPMPs that promote good servicing practices.

II. Lessons learned from the end-user incentive schemes and demonstration projects

II.1 Opportunities

29. The first two types of projects (end-user incentive schemes and demonstration projects) being implemented under the HPMPs have resulted in the following benefits, contributing to HCFC phase-out:

(a) Demonstrated cost and applicability of selected technologies, equipment performance, and potential operational savings;

(b) Assisted the low-volume-consuming (LVC) countries in particular in taking the first steps towards introducing HCFC-free technologies in the local markets by assisting a limited number of end-users adopting RAC systems or equipment using those technologies and demonstrating their use and performance;

(c) Facilitated the end-users' decision to adopt a low-GWP technology by sharing the risk through the funding provided by the Multilateral Fund under these projects, especially in larger applications where the cost of conversion is significant; and

(d) Contributed to increasing the local technicians' capacity to handle alternative technologies, and in several cases have assisted importers and distributors to start developing the supply chain for equipment, refrigerants and components associated with these technologies.

30. Factors that facilitated the implementation of many of these projects included training provided to technicians on the use of the alternative technology; workshops showcasing the use of the alternative technology; and awareness activities addressed to other end-users, technicians, suppliers and importers of equipment and refrigerants. Some projects have also been supported by regulations, such as established or scheduled bans on imports of new HCFC-based AC units, or approval from the firefighting authorities for the use of flammable refrigerants in RAC applications.

31. End-user incentive schemes and demonstration projects were relatively easier to implement in countries located close to markets where the alternative technologies selected were already available. One example of this is the project implemented in Cambodia to replace room AC units with HFC-32-based units, which benefited from its proximity to Thailand where this equipment is manufactured.

32. Projects that focused on the replacement of small appliances (e.g., room AC using HFC-32 or small commercial refrigeration units using R-290) were relatively easier to implement than the conversions of large equipment. Small-appliance-replacement projects covered a larger number of users (e.g., 83 in Malaysia, 135 in Maldives and 245 in Sri Lanka) and have reported that the new equipment was easily installed and operating without major technical difficulties.

II.2 Challenges and limitations

33. Even though the conversion or replacement of equipment has been achieved and the technical benefits of the selected technologies have been demonstrated, end-user incentive schemes and demonstration projects have in general not been shown to affect the rate of market uptake of low-GWP technology in the assisted country. The sustained adoption of the alternative technology by additional end-users still depends on variables beyond the scope of these projects. Specifically, market factors related to the widespread availability and affordability of equipment based on high-GWP HFCs (e.g., R-410A-based AC; HFC-134a- or R-404A-based commercial refrigeration), the limited availability and higher cost of equipment based on low-GWP alternatives and their components, and the lack of regulations restricting the supply of new HCFC-based equipment are barriers to the wider adoption of low-GWP technologies by end-users.

34. Specific challenges identified in the implementation of end-user incentive schemes and demonstration projects included:

For end-user incentive schemes

(a) The level of incentive proposed (15 to 50 per cent of the cost of the conversion or replacement of the equipment) was insufficient for some end-users to transition to low-GWP alternative technologies. In some cases, given the level of the investment required from the end-user, the beneficiary preferred not to participate in order to be able to choose fully available and non-flammable high-GWP technologies;

(b) In some cases, the implementation of the project required adjustments to the regulatory framework by local authorities (e.g., firefighting authorities), which caused delays and in one case resulted in changing the project for another activity;

(c) In some cases, the implementation of incentive schemes through a competitive selection process for the supply of low-GWP-based equipment was time-consuming and required additional efforts from the NOU and implementing agency due to a limited number of technology providers in the local market and a lack of availability of the low-GWP alternative technologies;

(d) In most cases the initiation of activities was delayed due to the need to design the incentive mechanism and the need to follow a formal selection process of project beneficiaries that ensured sustainability and transparency of the process;

(e) Several projects initially planned as end-user incentive schemes were eventually implemented as demonstration projects and focused only on understanding the costs and performance of the technology and building capacity for its future adoption, rather than on maximizing the number of end-users benefiting from the scheme;

For demonstration projects

(f) In the case of larger equipment in commercial refrigeration, there are risks associated with the introduction of the alternative technology due to the high cost of the R-717/R-744 technology, the supply of components, and the technical skills and know-how of engineers and technicians. Moreover, given the scale of demonstration projects and the investment made by the end-user, the project implementation timeline must adjust to the end-user's business plan schedule, including the timing for equipment renewal. In several of these projects, specialized technical assistance was provided and flexibility was applied to adapt to the end-user's pace of implementation and the changing conditions during the implementation of the project; and

(g) Not all reports received included evidence of having followed a methodology to measure and compare the performance of the baseline system and the new system, which is a key element to demonstrate to other end-users the benefits of adopting a new technology.

II.3 Cost and scale

35. End-user-related activities generally involve a small number of end-users, and therefore have a low level of associated HCFC phase-out that tends not to be recorded unless it is for a project addressing large equipment. Furthermore, unlike investment projects in the manufacturing sectors, where cost-effectiveness is measured based on the level of funds provided per kilogram phased out, end-user projects have been funded as a portion of the overall amount for the servicing sector.

36. Even though the amounts of HCFC phased out are limited, these projects have brought about the additional benefits of increasing end-users' and technicians' access to technology and associated technical know-how. In fact, of the different activities that are typically implemented in the refrigeration servicing sector, activities directed to replace end-user equipment are the ones with the potential to generate a direct reduction in HCFC consumption and a reduction in the bank of installed HCFCs. As the availability of HCFC-22 is reduced in Article 5 countries due to control measures from 2025 on, there could be better conditions for the implementation of end-user incentive schemes due to price differentials among refrigerants and components, as well as a wider availability of low-GWP alternatives, which would also be favoured by the implementation of the Kigali Amendment. Accordingly, Article 5 countries may wish to consider continuing to implement such projects, when the regulatory, prices and market conditions are appropriate to ensure sustained adoption of the alternative technology.

37. It has also been noted that where market conditions have been favorable, end-users have transitioned to low-GWP technologies with their own resources. For example, in a few countries in Latin America (including Chile, which implemented one project), several supermarkets have decided to adopt CO_2-based technology for certain applications. In cases like this, providing technical assistance to help other end-users better understand the technology and to support their technical staff (as well as enterprises installing these systems) in handling it, will facilitate the decision to undertake a technology transition.

38. The co-financing provided by the beneficiaries under end-user incentive projects (between 50 and 85 per cent of the cost of conversion) demonstrates their commitment to adopting the intended alternative technologies. However, as mentioned earlier, this does not guarantee scalability, as these projects can only cover a limited number of end-users. Moving from the scope achieved so far from these projects to a significant increase in the number of end-users transitioning to a specific technology and an eventual market transformation would require greater efforts, as well as different funding modalities and approaches.

39. For example, linking these projects with other existing programmes seeking to replace equipment for greater energy efficiency could extend their impact (e.g., in the past Brazil implemented a domestic refrigerator replacement programme with support from electricity utilities; and Mexico implemented an appliance replacement programme). Furthermore, for implementing agencies planning to have a large and sustained impact on end-users, there are examples of other financial mechanisms (i.e., GEF, GCF and regional development banks), which include a financial component to be implemented by local financial institutions. In those cases where market conditions are favorable for end-users to transition to low-GWP alternatives, these mechanisms could help accelerate the process of reducing installed HCFC banks.

III. Secretariat's observations

III.1 Impact of decision 84/84

40. In response to concerns related to end-user incentive schemes discussed by the Executive Committee between the 80th and 84th meetings (paragraphs 4-6), decision 84/84 established the circumstances that had to prevail in a country before demonstration and pilot projects could be directed to end-users, and requested bilateral and implementing agencies to comply with a number of conditions when submitting these projects.

41. The bilateral and implementing agencies reported that the application of decision 84/84 did not have an impact on projects that were already ongoing at the 84th meeting. However, difficulty in complying with several of the decision's requirements disincentivized the submission of new end-user-related projects.

42. The Secretariat notes that many of the of end-user incentive schemes that had been approved before adoption of decision 84/84 were not implemented because the necessary circumstances, as set out in the decision, were not in place (i.e., difficulties establishing regulations that would support the project; price differences between the baseline technology and the alternative; difficulties accessing the alternative technology, and risks associated with retrofitting equipment with flammable refrigerants).

43. The small number of projects submitted and recommended after decision 84/84 was approved (eight recommended and nine deferred to be considered at future tranches when compliance with the decision could be demonstrated) suggests that the application of the decision may have filtered out projects that might have encountered implementation difficulties or, in other words, for which the timing was not appropriate.

44. The Secretariat notes, however, that the decision, as adopted, referred not only to end-user incentive schemes but to "all pilot projects directed to end-users to transition to zero or low-GWP alternatives and/or reduce the use of controlled substances under existing or future stages of HPMPs". This may have disincentivized the submission not only of end-user incentive schemes but also of technology demonstration projects where the expectation of scalability is lower, as well as leakage-reduction projects, which have different characteristics.

III.2 Future applicability of the decision

45. From the analysis of the lessons learned from the application of decision 84/84, the Secretariat would like to bring to the consideration of the Executive Committee the following suggestions:

(a) To continue applying the decision to end-user incentive schemes, to ensure that the timing of submission of these proposals is appropriate in terms of circumstances in the country that allow the sustained adoption of the technology by end-users;

(b) To consider low-GWP technology demonstration projects at the end-user level when included under HPMPs, as in the case of any other technical assistance project under the HPMPs, noting that demonstration projects will continue to assist end-users and technicians in familiarizing themselves with low-GWP alternative technologies, and that they do not have the same purpose and expectation of scalability as end-user incentive schemes; and

(c) To consider leakage-reduction projects at end-users like any other technical assistance project under the HPMPs. Decision 84/84, by referring to all pilot projects directed to reduce use of controlled substances, included leakage-reduction projects. However, these projects should not require the application of decision 84/84, as they are focused on promoting good servicing practices, do not entail relevant investment in equipment associated with the new technologies, and do not depend on the status of an alternative technology in the market and regulations restricting HCFC-based equipment to be sustainable.

46. Regarding projects addressed to end-users as part of the servicing sector in the context of HFC phase-down, decision XXVIII/2 provides flexibility to prioritize HFCs, define sectors, select technologies and alternatives and elaborate and implement their strategies to meet agreed HFC obligations, based on their specific needs and national circumstances, following a country-driven approach. The Secretariat notes the following:

(a) As with CFCs and HCFCs, minimum circumstances should be in place to ensure the sustainable implementation of end-user incentive schemes and adoption of technology for a given application (i.e., regulatory measures restricting the manufacturing and import of HFCs and HFC-based equipment and components for specific applications; remaining consumption for specific applications limited to servicing; and a favourable price differential between HFCs and alternative refrigerants). Possible specific applications or subsectors that could comply with those circumstances may include HFC-based domestic and commercial stand-alone refrigerators. At this early stage, it is suggested that end-user incentive schemes be considered on a case-by-case basis, on the understanding that the circumstances listed above must be in place for specific applications before these projects can be implemented;

(b) Noting the limited impact of the current format of end-user incentive schemes, and the fact that their scaling up depends on other factors external to the projects, the bilateral and implementing agencies designing these projects may wish to consider other aspects that could help ensure a greater impact, such as potential energy-efficiency gains and opportunities for other modalities and sources of funding for scalability;

(c) At the early stage of HFC phase-down, technology demonstration projects could potentially provide opportunities to better understand and showcase the emerging alternative technologies. Therefore, countries should be able to include in their Kigali HFC implementation plans (KIPs), where appropriate, technology demonstration projects at a

limited number of end-users or training institutes when undertaken in conjunction with other activities under the KIP including technician training, awareness raising, the establishment of regulatory measures to facilitate the adoption of low-GWP technologies, and support to importers and distributors to supply the selected technology, including refrigerant, equipment and components. It is suggested that these projects, when included in KIPs, be considered like other technical assistance activities in the refrigeration servicing sector; and

(d) Leakage-reduction projects could promote a reduction in demand for high-GWP technologies (e.g., R-404A in large commercial refrigeration systems) in servicing and reduce emissions through better leak containment. Therefore, in the same manner as for HPMPs, it is suggested that these projects, when included in KIPs, be considered like technical assistance activities that promote good servicing practices in the refrigeration servicing sector.

III.3 Additional considerations emerging from the analysis of end-user incentive schemes

47. Additional considerations emerging from the analysis of end-user incentive schemes are listed below:

(a) *Relation of end-user projects with other activities in the servicing sector:* As shown in the implementation of end-user projects and reflected in decision 84/84, these projects need to be implemented in conjunction with training of technicians, ongoing recovery, recycling and reclaiming schemes, technical assistance to importers and distributors of equipment and components, and regulatory measures supporting the restriction of HCFC-based equipment and the adoption of low-GWP technologies. Particularly in the case of larger commercial refrigeration and AC systems, which in many cases are supplied by local installation and assembly enterprises, technical assistance to these enterprises will ensure that they have the capacity to design, install and service systems based on low-GWP alternatives. Support to suppliers will also facilitate their access to components;[15]

(b) *Conversion/replacement of large RAC installations in LVC countries:* The Secretariat notes that the conversion of larger commercial refrigeration systems requires a level of investment in equipment and design that is above the level of funds that several LVC countries have available under the refrigeration servicing sector, even if the conversions are largely co-financed by the end-user. At present, only larger non-LVC countries have the opportunity to implement these projects given their larger amount of funding available for activities in the servicing sector. Those LVC countries that have identified end-users prepared to convert and provide the required co-financing could benefit from targeted funding (e.g., a funding window) to provide access to LVC countries to implement a demonstration in one of those large end-users and determine a strategy and potential funding source for future scaling up; and

(c) *Energy efficiency:* While gains in energy efficiency have been reported from the conversion/replacement of RAC systems in end-user incentive schemes and demonstration projects, energy efficiency has so far not been taken into consideration in a systematic manner when designing the projects under the HPMPs. A better collection of data on potential savings achieved by the end-user due to energy efficiency may be required when

[15] Several recently approved projects have focused on the development of the supply chain by importing large quantities of small equipment for introduction to end-users through locally established appliance distributors and retailers (e.g., the creation of a supply chain for R-290-based air conditioners in Kenya). However, no information on their results is available yet.

designing these projects, as this factor may help scalability. A better understanding of the energy-efficiency aspects of these projects would also open up opportunities for additional modalities and sources of funding for scalability.

IV. Recommendation

48. The Executive Committee may wish:

(a) To note document UNEP/OzL.Pro/ExCom/92/43 containing the Report on end-user incentive schemes funded under the approved HCFC phase-out management plans (HPMPs);

(b) To continue applying decision 84/84 in considering end-user incentive schemes submitted for funding under the HPMPs;

(c) To consider not applying decision 84/84 to projects that involve demonstrating technology at a limited number of end-users, and leakage-reduction programmes at end-users, when submitted for funding under the HPMPs;

(d) To consider projects related to end-users submitted for funding under Kigali HFC implementation plans on a case-by-case basis and taking into account the considerations in paragraph 46 of document UNEP/OzL.Pro/ExCom/92/43;

(e) To encourage Article 5 countries and bilateral and implementing agencies, when designing end-user incentive schemes, to consider factors that would contribute to the scalability of end-user adoption of low-global-warming-potential alternatives, such as potential energy-efficiency gains that could be obtained and opportunities for additional modalities and sources of funding, whenever possible and on a voluntary basis;

(f) To consider the additional proposals presented in paragraph 47 of document UNEP/OzL.Pro/ExCom/92/43; and

(g) To request the Secretariat to provide an update to the report contained in document UNEP/OzL.Pro/ExCom/92/43 at the first meeting of the Executive Committee in 2028, to reassess the effectiveness of end-user incentive schemes and demonstration projects directed to end-users including updated project results, the cost-effectiveness analysis, discussion of the impact of the decision on such projects, and other observations.

Annex

SUMMARY OF INFORMATION COLLECTED ON THE END-USER-RELATED PROJECTS

Table 1. End-user incentive schemes to convert or replace HCFC-based equipment

	Country	Implementing agency	Subsector / Application	Alternative technology introduced	Cost (US $)		No. of conversions or replacements		HCFC phased out (mt)	Date of project completion
					Approved	Co-financing	Planned	Compl.		
	Completed projects									
1	Bhutan	UNDP	Room AC/Commercial AC	HFC-32	79,000	70% of new unit	65	15	0.03	Aug-18
2	Croatia[1]	UNIDO	Commercial industrial RAC	HFCs/ -290/R-717	360,000	870,000	10	32	2.22	Dec-15
3	Cuba	UNDP	Commercial RAC	R-404A	350,000	n/a	500	715	n/a	Dec-20
4	Fiji	UNDP	Room AC	Several	48,500	70% of new unit	33	96	0.19	Dec-22
5	Ghana	UNDP	Commercial refrigeration	R-407C	38,000	160,296	14	4	0.46	Sep-17
6	Kyrgyzstan	UNDP	Commercial refrigeration	R-290	180,000	50% of new unit	n/a	66	0.04	Dec-21
7	Madagascar*	UNIDO	Room AC	R-290	120,000	n/a	6	n/a	n/a	Mar-22
8	Malaysia	UNDP	Room AC/Commercial AC	HFC-32/CO_2	98,000	110,000	4	83	0.20	Apr-17
9	Maldives	UNDP	Room AC/Fisheries	HFC-32/R-438A**	220,000	369,443	765	150	2.99	Nov-20
10	Nepal	UNDP	Room AC/Commercial and industrial RAC	HFC-32	36,000	111,607	18	34	0.08	Dec-22
11	Sri Lanka	UNDP	Room AC	HFC-32	60,866	196,000	204	245	0.61	Dec-20
12	Togo*	UNIDO	Room AC	R-290	90,000	n/a	70	n/a	n/a	Jun-21
13	Tunisia*	UNIDO/France	Commercial AC	R-290	90,000	n/a	3	n/a	n/a	Dec-21
	Subtotal for completed projects				**1,770,366**	**1,817,346**	**1,692**	**1,440**	**6.83**	
	Ongoing projects									
14	Cambodia	UNDP	Room AC	HFC-32/ R-290	350,000	75% of new unit	900	69	0.69	Dec-24
15	Cameroon	UNIDO	Commercial and industrial refrigeration	R-290/HFO /HFC-32	100,000	TBD	6	n/a	n/a	Dec-25
16	Kenya	France	AC	R-290	40,000	TBD	500	TBD	TBD	Dec-24
17	Mauritius	Germany	AC	R-290	250,000	TBD	TBD	TBD	TBD	Dec-30
18	Republic of Moldova	UNDP	Commercial refrigeration	Several	183,500	TBD	4	TBD	TBD	Dec-30
	Subtotal for ongoing projects				**823,866**	**TBD**	**1,410**	**69**	**0.69**	
	Total				**2,593,866**	**1,817,346**	**3,102**	**1,509**	**7.52**	

[1] Project approved before decision XXV/16 of the Parties, which approved the request by Croatia to be removed from the list of Article 5 countries.

* As of 27 April 2023, designated implementing agencies have not submitted the updated reports for these countries.

**Temporary use of R-438A was based on the availability of technology, subsequently, a demonstration project for the sector with a lower-GWP technology based on R-448A was implemented.

Table 2. Demonstration projects for alternative technologies

	Country	Implementing agency	Subsector / Application	Alternative technology introduced	Cost (US $)		No. of conversions or replacements		HCFC phased out (mt)	Date of project compl.
					Approved	Co-financing	Planned	Compl.		
	Completed projects									
1	Chile	UNDP	Supermarket	Transcritical CO_2	485,863	2,482,790	5	3	3.30	Dec-18
2	China	Germany	Commercial refrigeration (supermarket)	Transcritical CO_2	66,500	472,000	1	1	n/a	Aug-19
3	Dominican Republic	UNDP	AC	R-290	60,000	n/a	75	50	n/a	Dec-21
4	Ecuador	UNIDO	Cold room	R-290	n/a	20,000	1	1	0.03	Dec-19
5	Georgia	UNDP	Cold room/ chiller	CO_2	91,300	6,270	1	1	0.15	Sep-21
6	Grenada	UNEP	Room AC	R-290	9,000	n/a	2	2	n/a	Dec-18
7	Republic of Moldova	UNDP	Commercial refrigeration	CO_2	64,000	210,118	2	2	0.2	Jun-20
8	Sudan*	UNIDO	AC	R-290	58,000	n/a	n/a	80	n/a	Jun-23
9	Venezuela (Bolivarian Republic of)	UNIDO	Commercial AC (chiller)	R-290	200,000	n/a	3	3	0.01	Jan-19
10			Domestic AC			n/a	500	5	0.01	Oct-22
	Subtotal for completed projects				**976,663**	**3,191,178**	**588**	**146**	**3.70**	
	Ongoing projects									
11	Chile	UNIDO	Demonstration projects in cold rooms and AC systems	HFO-1234ze	n/a	150,000	5	1	0.08	Jun-23
12	Ecuador	UNIDO	Cold room	R-290	80,000	n/a	1	n/a	n/a	Dec-26
13	Kenya	France	Chiller (horticulture)	R-290/ glycol	110,000	n/a	75	n/a	n/a	Dec-24
14	Kenya	France	Commercial refrigeration	CO_2	600,000	n/a	1	n/a	n/a	Dec-24
15	Mauritius	Germany	Supermarket	R-744	200,000	n/a	1	1	n/a	Dec-28
16	Nigeria	UNDP	Room AC	R-290	20,000	n/a	2	20	n/a	Dec-23
17	Türkiye (Republic of)*	UNIDO	Cold room/ supermarket/ chiller	CO_2/ NH_3/ R-448A/ R-290/ HFO-1233zd	380,000	n/a	2	n/a	n/a	Dec-23
18	Saint Vincent and the Grenadines	UNEP	Commercial AC	R-290	99,800	38,876	n/a	39	n/a	Dec-26
19	South Africa*	UNIDO	Commercial and industrial refrigeration	R-290/ CO_2/ NH_3/ HFO	200,000	n/a	1	n/a	n/a	Dec-23
	Subtotal for ongoing projects				**1,689,800**	**188,876**	**88**	**61**	**0.08**	
	Total				**2,666,463**	**3,380,054**	**676**	**207**	**3.78**	

* As of 27 April 2023, designated implementing agencies have not submitted the updated reports for these countries.

Table 3. Leakage reduction programmes for end-users*

	Country	Implementing agency	Subsector / Application	Alternative technology introduced	Cost (US $)		No. of conversions or replacements		HCFC phased out (mt)	Date of project completion
					Approved	Co-financing	Planned	Completed		
	Completed projects									
1	Argentina	UNIDO	Commercial refrigeration	Not applicable	471,000	n/a	40	29	0.83	Jul-20
2	Brazil	Germany	Commercial refrigeration	Not applicable	860,736	n/a	5	3	0.77	Dec-19
3	Guatemala	UNIDO	Commercial refrigeration	Not applicable	20,000	n/a	1	1	0.02	Dec-21
4	Iran (Islamic Republic of)	Germany	Commercial refrigeration	Not applicable	415,000	n/a	2	3	n/a	Dec-14
5	Venezuela (Bolivarian Republic of)	UNIDO	Commercial refrigeration	Not applicable	157,144	n/a	100	5	0.01	Oct-22
	Subtotal for completed projects				**1,923,880**		**108**	**41**	**0.80**	
	Ongoing projects									
6	Chile	UNIDO	Commercial refrigeration	Not applicable	190,100	n/a	4	n/a	n/a	Dec-24
7	Guatemala	UNIDO	Commercial refrigeration	Not applicable	25,000	n/a	1	n/a	n/a	Dec-27
8	Honduras	UNIDO	Commercial refrigeration	Not applicable	57,000	n/a	3	n/a	n/a	Dec-27
9	Nicaragua	UNIDO	Commercial refrigeration	Not applicable	66,000	n/a	1	n/a	n/a	Dec-27
10	Oman*	UNIDO	Commercial refrigeration	Not applicable	15,000	n/a	20	n/a	n/a	Dec-24
11	Viet Nam	The World Bank/Japan	Industrial refrigeration	Not applicable	52,800	n/a	10	n/a	n/a	Dec-23
	Subtotal for ongoing projects				**405,900**	**n/a**	**19**	**n/a**	**n/a**	
	Total				**2,329,780**	**n/a**	**127**	**41**	**0.80**	

* As of 27 April 2023, designated implementing agencies have not submitted the updated reports for these countries.