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EXECUTIVE COMMITTEE OF
THE MULTILATERAL FUND FOR THE
IMPLEMENTATION OF THE MONTREAL PROTOCOL
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**REPORT ON END-USER INCENTIVE SCHEMES FUNDED UNDER APPROVED
HCFC PHASE-OUT MANAGEMENT PLANS (DECISION 82/54)**

Background

1. At its 80th and 81st meetings, the Executive Committee raised concerns related to the end-user incentive schemes to promote the conversion of refrigeration and air-conditioning (RAC) systems to HCFC alternatives included in several funding tranche requests of HCFC phase-out management plans (HPMPs). The concerns included the lack of strong commitment from the governments/end-users to support the adoption of the low global-warming potential (GWP) alternative technologies selected, the lack of co-financing required to pay for the conversions, the lack of training associated with the conversions, and the subsequent 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 programme, and that end users would provide co-financing to participate in the scheme.

2. At its 82nd meeting, upon a request by a member, 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:

- (a) To compile information on end-user incentive schemes (also referred to, *inter alia*, as demonstrations, pilot projects, and incentive programmes) funded under approved HPMPs; and
- (b) To submit a report including:
 - (i) Information on approved activities, such as tonnes to be phased out, funding, co-funding to be provided, number of beneficiaries, sector, and associated technical assistance;
 - (ii) Status of schemes, including information on delays, if relevant; and

- (iii) Decisions of the Executive Committee relevant to end-user conversions as they pertained to the end-user incentive schemes approved under HPMPs (decision 82/54).

Scope of the document

3. In response to decision 82/54, the Secretariat prepared the present document comprising three parts and a recommendation:

- (a) Decisions of the Executive Committee relevant to end-user conversions;
- (b) Information on approved end-user-related activities, including tonnes to be phased out, funding, co-funding to be provided, number of beneficiaries, sector, associated technical assistance, and status of schemes including information on delays;
- (c) Secretariat's observations; and
- (d) Recommendation.

4. The document also contains the following two annexes:

Annex I Inputs provided by the bilateral and implementing agencies by country

Annex II Summary of the Multilateral Fund policies related to end-user activities

Methodology used for data collection

5. For the preparation of the present document, the Secretariat undertook a detailed analysis of all stages I and II of HPMPs for Article 5 countries so far approved, and all tranche progress reports and implementation plans that have been considered by the Executive Committee. As a result, the Secretariat identified 66 activities related to end-user incentive schemes.

6. As information on end-user incentives had not been reported in a systematic way, the Secretariat developed a template document containing the elements requested in decision 82/54(b)(i) (i.e., project objective and project description; tonnes to be phased out; funding from the Fund and co-funding from end-users; number of beneficiaries, sector and associated technical assistance), and distributed it to the bilateral and implementing agencies. During the Inter-agency coordination meeting,¹ the matter was discussed and bilateral and implementing agencies provided additional insights on the implementation of end-users projects.

7. Subsequently, bilateral and implementing agencies provided detailed information as contained in Annex I to the present document. The Secretariat appreciates the inputs submitted by the agencies, which constitute the basis for the analysis contained in the present document.

Decisions of the Executive Committee relevant to end-user conversions

8. Given that several of the controlled substances under the Montreal Protocol are used by all countries for servicing RAC equipment, the Executive Committee has given due consideration to activities related to this sector since the inception of the Multilateral Fund.

9. Matters related to end-user incentive programmes, under the refrigeration servicing sector, have been of interest of the Committee as early as its 26th meeting, when it requested the Secretariat, in

¹ Montreal, 9-11 October 2019.

conjunction with the implementing agencies, to prepare a paper on the circumstances under which the Executive Committee could consider projects to retrofit commercial refrigeration appliances and on how the incremental costs of such projects should be calculated (decision 26/38).

10. In line with decision 26/38, the Executive Committee considered a document on circumstances for the consideration of ODS phase-out in the commercial refrigeration end-user sector,² based on which the Committee adopted guidelines for end-user conversion in the commercial refrigeration sector. These guidelines, established relevant circumstances that had to prevail before priority would be accorded to end-user conversion activities, *inter alia*, that controls on production and import on CFC and CFC-based equipment were in place and effectively enforced; the remaining consumption of CFCs was mainly in the refrigeration servicing sector, a comprehensive profile of all remaining consumption has been made available to the Committee, and either no other activities would allow the country to meet its CFC control obligations, or the price of CFCs relative to substitute refrigerants, has been high for at least nine months and is predicted to continue to increase (decision 28/44).

11. From that point, a limited number of funding requests for retrofitting of commercial refrigeration equipment were submitted and assessed on a case-by-case basis, with priority given to conversion of cold stores in the agricultural, fisheries or other food-chain industries that were important for the economies of the countries concerned.

12. At its 31st meeting, the Executive Committee concluded its discussions on draft guidelines on refrigerant management plans (RMPs), addressing the needs for low-volume consuming (LVC) countries, as their entire consumption of CFC was for servicing refrigeration equipment (although broad guidelines were also provided to non-LVC countries); under decision 31/48 (on RMPs), Article 5 countries could include incentive programmes to encourage retrofitting of refrigeration equipment.

13. At its 32nd meeting, the Executive Committee considered three proposals related to incentive programmes to encourage retrofitting of refrigeration systems. These proposals would use up most or all of the funding available for countries with RMPs already approved, would not cover all enterprises in the country, and would not provide sufficient phase-out to enable the countries to meet their compliance obligations without other measures being taken. Following a discussion, the Committee decided that proposals for incentive programmes to encourage retrofitting of refrigeration equipment could be submitted within an RMP, on the understanding that the implementing agency should consult with the country and all other agencies implementing components of the RMP; the country concerned was fully informed about all the investment and non-investment activities which might be available, and the timing of the proposed activity was appropriate for the country's circumstances (decision 32/28).

14. Since then, end-user incentive programmes were included in national CFC phase-out management plans, which in many cases helped reduce the use of CFC-12, through the introduction of drop-in blends or R-600a, particularly for domestic and small commercial refrigeration equipment.

15. With the acceleration of the phase-out of HCFCs, many Article 5 countries included proposals for end-user conversion/replacement of HCFC-based equipment (mostly residential air conditioners) to low-GWP-based refrigerants under their HPMPs. At its 72nd meeting, the Secretariat brought to the attention of the Executive Committee a proposal by an Article 5 country that had institutionalized a programme for retrofitting existing HCFC-22-based equipment to hydrocarbon (HC)-based refrigerants, where the risks had been assessed and managed and a standard for the safe set-up and operation of HC-based equipment had been applied. Based on this proposal, the Committee decided to include the following stipulation in tranches of HPMPs, projects or activities that proposed the retrofit of HCFC-based equipment to flammable or toxic refrigerants: "that if the country engaged in retrofitting HCFC-based RAC equipment to flammable or toxic refrigerants and associated servicing, it did so on the understanding that the country

² UNEP/OzL.Pro/ExCom/28/47

assumed all associated responsibilities and risks” (decision 72/17). This stipulation was further strengthened by adding the following text “and retrofits should be done only in accordance with the relevant standards and protocols” (decision 73/34).

16. Also at its 72nd meeting, the Executive Committee concluded its discussions on minimizing adverse climate impact of HCFC phase-out in the refrigeration servicing sector, based on documents prepared by the Secretariat.³ In doing so, the Committee *inter alia* encouraged Article 5 countries, when implementing their HPMPs, to consider focusing activities in the refrigeration servicing sector on training of technicians, good practices, the safe handling of refrigerants, containment, recovery and recycling and reuse of recovered refrigerants rather than retrofitting (decision 72/41(c)(iii)).

17. In recent decisions to strengthening the implementation of end-user incentive components based on national circumstances, the Executive Committee has requested bilateral and implementing agencies to provide a detailed implementation plan for the end-user incentive programme, including co-financing from the beneficiaries, being proposed in stage II of HPMPs, to optimize the effectiveness of the HPMPs (decisions 80/58(h)(i) and 82/59(h)(i)).

Information on approved end-user-related activities

18. Based on an analysis of the information submitted by the bilateral and implementing agencies, the Secretariat noted that 38 of the 66 end-user-related activities were initially intended to retrofit HCFC-based equipment to flammable low-GWP refrigerants. However, due to several factors at the country level, and in light of decisions adopted by the Executive Committee in particular decisions 72/17, 72/40, and 73/34, end-user-related activities as originally proposed were either postponed or redesigned to prioritize other activities in the refrigeration servicing sector. The majority of the funding associated with those activities, were reallocated mainly to strengthening training institutes or to increase the training programmes on good service practices for refrigeration technicians. The reallocation of the end-user-related activities have been reported under relevant tranche progress reports of stages I and II of HPMPs.

19. The status of implementation of the identified end-user-related activities, as of the 84th meeting, is shown in Table 1.

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

Agency	Total	Implemented	Redirected
UNDP	19	13	6
UNEP	10	2	8
UNIDO	25	8	17
World Bank	1	-	1
France	1	1	-
Germany	10	4	6
Total	66	28	38

20. Regarding the 28 end-user-related activities being implemented, the Secretariat identified the following three distinct categories:

- (a) End-user incentive schemes to convert or replace HCFC-based equipment;
- (b) Projects to demonstrate alternative technologies at an end-user installation; and
- (c) Leakage reduction programmes for end-users.

³ UNEP/OzL.Pro/ExCom/70/53/Rev.1 and UNEP/OzL.Pro/ExCom/72/42

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

21. A total of 15 projects are being implemented as end-user incentive schemes to convert or replace HCFC-based equipment. While there are variations among the projects, the main approach consists of the conversion or replacement of existing HCFC-based equipment to operate with HFCs (mainly HFC-32) or natural refrigerants (i.e., R-290 or ammonia). These conversions or replacements have taken place predominantly with private end-users and mostly in the room AC sector, with co-financing provided by the beneficiaries.

22. In most of these projects, the Multilateral Fund covers a portion of the cost of conversion (or replacement), that varies from 25 to 50 per cent, depending on specific circumstances related to the country, beneficiaries and application. In one case, the project provided a predetermined incentive for the replacement of HCFC-based equipment (i.e., from US \$120 for a 9,000 Btu/h AC unit to US \$250 for a 24,000 Btu/h unit), with the remaining balance being paid by the beneficiary. Table 2 summarizes the information extracted from the reports submitted by the agencies on end-user incentive schemes for conversion or replacement of HCFC-based equipment.

Table 2. End-user incentive schemes for conversion or replacement of HCFC-based equipment

Country*	Agency	Subsector/ application	Alternative technology	Cost (US \$)		Conversions/ replacements		HCFC phased out (mt)	Date of completion
				Approved	Co-financing	Plan	So far		
Bhutan	UNDP	Room AC/ Commercial AC	GWP<675	79,000	7,982	65	15	0.03	Aug-18
Brunei Darussalam	UNDP	Room AC/ Large AC	HFC-32/ R-290	33,500	n/a	35	n/a	n/a	Dec-20
Cambodia	UNDP	Room AC	HFC-32 R-290	350,000	n/a	900	69	0.14	Dec-24
Croatia	UNIDO	Commercial Industrial RAC	HFCs/ R-290/ R-717	360,000	870,000	10	32	2.22	Dec-15
Cuba	UNDP	Commercial RAC	R-404A	350,000	n/a	500	715	n/a	Dec-20
Fiji	UNDP	Room AC/ Fishery	Several	48,500	n/a	33	n/a	n/a	Dec-20
Ghana**	UNDP	Commercial ref.	R-407C	38,000	160,295	13	4	0.46	Sep-17
Madagascar	UNIDO	Room AC	R-290	120,000	n/a	6	n/a	n/a	May-20
Malaysia	UNDP	Room AC/ Commercial AC	Several	98,000	110,000	4	83	0.20	Apr-17
Maldives	UNDP	Room AC/Fishery	HFC-32/ R-438A	220,000	369,443	765	150	1.50	Nov-20
Nepal	UNDP	Room AC/ Commercial Industrial RAC	HFC-32	36,000	111,607	18	24	0.08	Dec-20
Sri Lanka	UNDP	Room AC	HFC-32	60,866	166,410	204	199	0.52	Dec-20
Togo	UNIDO	Room AC	R-290	90,000	n/a	3	n/a	n/a	Dec-21
Total				1,883,866	1,795,737	2,556	1,292	5.15	

(*) End-user activities in Kenya and Mozambique have been recently approved; however, information on implementation is not yet available.

(**) A programme providing tools to servicing workshops to facilitate conversion of AC units from HCFC-22 to R-290 following strict safety guidelines enforced by the Ministry of Environment has not been included as it does not address end-users directly.

23. These projects have been supported by 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 been supported by regulations, such as future bans on imports of new HCFC-based AC units, or approval from the fire department for the use of flammable refrigerants in RAC applications. In one case, where the country was located within the European Union (EU) territory, the local adoption of

EU regulations to phase out HCFC ahead of schedule, coupled with the increased prices of HCFCs, ensured that other HCFC-based end-users followed a similar approach of conversion or replacement of their systems.

24. While most of the end-user projects are still ongoing, additional benefits that have been reported by bilateral and implementing agencies include: reduced use of energy by the new systems, the opportunity to showcase new technologies to stakeholders in the countries, and import of alternative technologies into the countries. For example, in one country, all end-users converted or replaced their HCFC-based systems following the project, due to: the legal obligations to phase out HCFCs ahead of the original schedule, a significant increase in HCFC prices, and the availability of an environmental fund to support retrofits and conversions. For all the other cases, there is limited 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.

25. Some of the challenges identified in the implementation of these projects include:

- (a) Lack of availability of the selected low-GWP alternative technologies and difficulties in identifying technology providers in local markets. In some cases, implementation of incentive schemes through a “competitive selection process” was not feasible due to a limited number of technology providers;
- (b) Lack of interest of the end-users, as the incentive was insufficient to pay for the additional upfront cost of the low-GWP alternative technology or for the higher operating and maintenance cost of the RAC equipment using alternative technology (e.g., in one case, the cost of the HFC-32 AC units outweighed the incentive received);
- (c) Time-consuming and complicated processes for approval by the relevant authorities to introduce RAC equipment based on flammable refrigerants;
- (d) Publicity against RAC equipment based on flammable refrigerants resulting in higher perceived risks relating to the use of such equipment; and
- (e) Lack of low-GWP alternative refrigerants for retrofit of equipment in certain applications. For example, in the case of fisheries, most vessels are aged between 25 and 35 years, with frequent leakage and maintenance issues; at present, there is no suitable, viable low-GWP alternative that can be applied to these vessels.

Projects to demonstrate alternative technologies

26. A total of 12 projects are being implemented to demonstrate alternative technologies. The approach usually consists of the conversion or replacement of one or a limited number of refrigeration or AC units operating in a public or private institution to demonstrate the safe use of the low-GWP alternative being proposed (i.e., R-290, CO₂). In these projects, the Multilateral Fund covers the cost of the limited number of units being converted or replaced, and the beneficiary institutions provide in-kind contribution mainly as technical support for installation, maintenance and monitoring of equipment. Table 3 summarizes the information extracted from the reports submitted by the agencies from demonstration projects being implemented.

Table 3. Projects to demonstrate alternative technologies

Country*	Agency	Subsector/ application	Alternative technology	Cost (US \$)		Conversions/ replacements		HCFC phased out (mt)	Date of completion
				Approved	Co-financing	Plan	So far		
Chile	UNDP	Supermarket	Transcritical CO ₂	485,863	2,482,790	5	2	3.30	Dec-18
Costa Rica*	UNDP	Cold room	CO ₂ /NH ₃	524,000	419,000	1	1	1.31	Jan-18

Country*	Agency	Subsector/ application	Alternative technology	Cost (US \$)		Conversions/ replacements		HCFC phased out (mt)	Date of completion
				Approved	Co-financing	Plan	So far		
Ecuador	UNIDO	Cold room	R-290	n/a	n/a	1	1	0.03	Nov-19
Grenada	UNEP	Room AC	R-290	9,000	-	2	2	n/a	Dec-18
Iran (Islamic Republic of)	Germany	Supermarket	R-290	415,000	-	2	3	n/a	Dec-14
Mauritius	Germany	Supermarket	R-744	200,000	-	1	1	n/a	Dec-28
Mauritius	Germany	Supermarket/ supply chain	R-290/ R-744	250,000	-	n/a	n/a	n/a	Dec-30
Saint Vincent and the Grenadines	UNEP	Commercial AC	HC	99,800	-	2	2	n/a	Dec-26
Turkey	UNIDO	Cold room; supermarket Chiller	CO ₂ /NH ₃ R-448A/ R-290 HFO-1233zd	380,000	n/a	3	1	0.09	Dec-21
Venezuela (Bolivarian Republic of)	UNIDO	Commercial AC (chiller)	R-290	n/a	n/a	1	1	0.008	Nov-18
Total				2,363,663	2,901,790	18	14	4.72	

* Information from Final Report of demonstration project. Additional demonstration projects have been identified, including supermarkets in Argentina (final report will be submitted to the 85th meeting) and Georgia (no information on implementation yet available).

27. These demonstration projects have been supported by training provided to technicians mainly to familiarize them with the alternative technology introduced, awareness-raising activities, and other supporting activities to ensure the availability of the alternative technologies in the local markets. For example, one country supported the demonstration project by including a rebate for every tonne of cooling capacity of HCFC-22 and R-410A replaced with HFC-32-based equipment, while two other countries adopted new regulations and standards that will allow safe handling in the use and servicing of the alternative refrigerants being introduced.

28. Additional benefits that have been reported by the bilateral and implementing agencies include: 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 (up to 30 per cent in one case); and the opportunity to showcase new technologies to stakeholders in the countries, opening the local markets to these technologies.

29. 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; there is also limited information on the challenges encountered in the implementation of these projects.

Leakage reduction programmes at end-users

30. In only one country, the end-user project focused on improving containment practices for existing HCFC systems in two supermarkets by *inter alia* replacing old inefficient parts and using better seals, valves, pipe connections and other components. This practice led to energy savings and lower demand for HCFCs. 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 covered by the Multilateral Fund, while the beneficiary supermarket paid for technicians' services, consumables and servicing tools.

31. Implementation of the project resulted in annual HCFC-22 leakage rates reductions from 130 per cent of the refrigerant charge to zero; the system's coefficients of performance were improved by up to 13.4 per cent; and energy consumption was reduced. The project was supported by training on best practices provided to the supermarket technical staff. In addition, under the HPMP for that Article 5 country, an additional 4,800 technicians were trained in best practices related to *inter alia* sealed system design, leak detection, brazing, recovery and recycling, data recording, and planned preventive maintenance. No specific regulatory measures were enacted, as the scope of the project was to demonstrate best practices in the refrigeration servicing sector.

32. Some of the challenges encountered during project implementation included:

- (a) The lack of availability of components and equipment such as the fixed leak-detection and monitoring system;
- (b) Limited number of suppliers interested in participating in tenders and offering supplies in accordance with the project's technical specifications and requirements (the tender had to be published several times, delaying the project); and
- (c) Delays in equipment delivery, which led to the withdrawal of two initially selected supermarkets.

Secretariat's observations

33. The projects relating to end-user incentive schemes were approved mainly for LVC countries between 2010 and 2013; for non-LVC countries, the number of end-user incentive scheme-related projects approved was limited. Keeping in view the amount of funding available under the servicing sector plans (including end-user incentive schemes) in stages I and II of HPMPs,⁴ it is difficult to assess the scalability of adoption of alternative low-GWP technologies promoted in end-user incentive schemes, except in situations where the HCFC use is identified in a particular application (e.g., HCFC-22 use in fisheries),⁵ or where one or more end-users decide in adopting the alternative technology in their facilities after demonstrating its performance (e.g., R-744-based technology in supermarkets).

34. Market factors particularly relating to the availability of equipment based on high-GWP, ODS-free refrigerants (e.g., HFC-134a, R-404A in refrigeration applications; or R-410A and R-407C in AC systems),⁶ and lack of regulations restricting the introduction of new HCFC-based equipment covered under the end-user incentive schemes, pose a challenge in achieving the intended market penetration of the incentive schemes.

35. Decrease in availability of HCFCs with accelerated HCFC phase-out plans (e.g., phase-out of HCFCs by 2025 instead of 2030 as proposed in stages I and II of HPMPs of several Article 5 countries), coupled with implementation of end-user incentive programmes promoting the adoption of low-GWP alternative technology, could result in faster reductions of HCFC consumption and in the phase-in of low-GWP-based technologies.

36. The limited availability of non-HCFC low-GWP technology options in RAC applications has an impact on scalability of the end-user incentive schemes. Up to now, the technical options relating to different RAC applications covered under the incentive schemes are still under development; the

⁴ Decision 60/44 for stage I of HPMPs and decision 74/50 for stage II of HPMPs

⁵ Fisheries sector retrofit programmes face a challenging situation relating to availability of safe low-GWP refrigerant based alternative technologies.

⁶ With Kigali Amendment in force from 1 January 2019 and increasing number of countries becoming Parties to the amendment, low-GWP refrigerant based refrigeration and air-conditioning equipment is experiencing higher growth; this increase is also reported under the recent TEAP task force report on energy efficiency.

availability and cost-effective options in local markets is still limited (e.g., HFC-32/R-290-based AC equipment or R-744-based commercial refrigeration equipment). This situation is changing with increasing levels of availability of low-GWP-refrigerant-based equipment in certain applications in local markets; activities related to the Kigali Amendment (e.g., enabling activities) have also played a role in such technology adoptions in the recent past (i.e., last two years or so).

37. Based on the experiences in several Article 5 countries of retrofitting CFC-based domestic refrigerators and stand-alone commercial refrigeration equipment during the final period of CFC phase-out, during the early period of approval of stage I of HPMPs, one of the main objective of end-user incentive schemes included therein, was the retrofit of HCFC-based refrigeration equipment in specific AC and refrigeration applications. However, in early implementation phases, these incentives were either postponed or redesigned to prioritize other activities such as additional training for technicians or procurement of equipment and service tools in support to servicing workshops and/or national institutions, for the following reasons:

- (a) Increased complexities associated with ensuring industry practices and processes for safe low-GWP retrofits for equipment designed for non-flammable refrigerants, including rigorous training and capacity building of technicians on retrofitting equipment, certification process for technicians to undertake such retrofits;
- (b) Long and time consuming process for modification of the regulatory framework for monitoring safe adoption of retrofit of HCFC-based equipment with flammable refrigerants;
- (c) Availability of retrofit options with high-GWP refrigerants (e.g., R-407C for HCFC-22-based ACs) as well as high-GWP refrigerant-based equipment;
- (d) Policy decisions adopted by the Executive Committee to avoid unsafe practices in implementing retrofits using flammable refrigerants in equipment originally designed for using non-flammable refrigerants (e.g., decisions 72/17, 72/40, and 73/34).

38. Under business as usual scenario, market factors would favour the adoption of new HCFC-free high-GWP refrigerant based equipment (e.g., R-410A-based AC; HFC-134a- or R-404A-based stand-alone commercial refrigeration) as a replacement to HCFC-based equipment that is being retired. Lack of policies and regulations at the national level to restrict the use of new HCFC-based equipment and encourage the adoption of low-GWP alternative technologies, influence the overall impact undertaken by the end-user incentive schemes. Regulations and other measures that would promote the adoption of low-GWP alternatives including those considered under the incentive scheme, along with HCFC phase-out-related measures, could increase the impact of end-user incentive schemes.

39. Co-financing by the beneficiaries under end-user incentive schemes, varied between 50 per cent and 85 per cent. The co-financing levels demonstrate the commitment of the beneficiaries to adopting the intended alternative technologies under the scheme; however, they do not guarantee scalability of the technology adopted, as these schemes only demonstrated the performance of alternative technologies for a limited number of end-users. Linkage of these schemes with other programmes that resulted in the replacement of equipment (e.g., Brazil domestic refrigerator replacement programme implemented with support from electricity utilities; Mexico appliance replacement programme), could result in scalability of these programmes (and, moreover, in increased amounts of HCFC-22 recovered from replaced units), noting that such schemes should be designed to include low-GWP refrigerant adoption in the equipment.

40. Training and capacity-building for technicians for the adoption of alternative low-GWP technologies, are implemented under the end-user incentive schemes and under training programmes included as part of the servicing sector activities under HPMPs. The enhanced capacity building results in

higher levels of confidence among the stakeholders regarding the adoption of alternative technologies. In some cases, equipment support provided to technical institutions had supported the safe adoption of low-GWP alternative technologies.

41. In one country, the end-user incentive scheme focused on leakage reduction in supermarkets, and resulted in substantial reduction in HCFC-22 leakage and better cooling performance of the equipment. Replication of this experience in other Article 5 countries, entails capacity building of end-users and associated technicians to undertake detailed assessment of leakage of commercial refrigeration equipment use in supermarkets and adopting good practices for leakage reduction and recovery and reuse of HCFCs.

Recommendation

42. The Executive Committee may wish:

- (a) To note document UNEP/OzL.Pro/ExCom/84/63 on the report on end-user incentive schemes funded under approved HCFC phase-out management plans (HPMPs) (decision 82/54);
- (b) To consider end-user incentive schemes under existing or future stages of HPMPs, on a case-by-case basis, taking into consideration the policy framework for restricting the use of controlled substances under the Montreal Protocol and favouring the adoption of the proposed alternative technology under the incentive schemes, and the scalability of the alternative technology being proposed in light of local market conditions;
- (c) To request bilateral and implementing agencies, when submitting end-user incentive schemes as indicated in sub-paragraph (b) above:
 - (i) To design end-user incentive schemes for specific refrigeration and air-conditioning applications, to the extent feasible, that would accelerate the phase-out of the controlled substance used in such applications and would promote early adoption of the alternative technology being proposed;
 - (ii) To develop regulations and other measures, as required, restricting the use of the controlled substances and promoting the early adoption of the alternative technology being proposed in the identified applications;
 - (iii) To provide information on the actual level of co-financing by all the beneficiary end-users participating in the incentive scheme and to describe the actions they would undertake to promote the adoption of the proposed technology;
 - (iv) To include training, capacity building and technical assistance for adopting the proposed alternative technology in a cost-effective manner, taking into consideration synergies with the training programmes implemented under the approved HPMPs;
 - (v) To forecast the impact of the end-user incentive schemes in terms of the phase-out of controlled substances and the phase-in of alternative refrigerants; and
- (d) To request bilateral and implementing agencies to submit detailed reports on existing end-user incentive schemes once the schemes have been completed, including the actions undertaken to promote the adoption of the alternative technology, based on which the Secretariat could develop fact sheets that could be used during project implementation.

Annex I

DECISIONS RELATED TO THE IMPLEMENTATION OF RETROFIT, EQUIPMENT REPLACEMENT AND END-USER INCENTIVE SCHEMES DURING CFC PHASE-OUT

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

- (a) Production and import control on CFC and CFC-based equipment in place and effectively enforced, and restricted deployment of new CFC components;
- (b) The country's major remaining consumption is for the servicing of refrigeration and air-conditioning equipment;
- (c) Comprehensive data on the profile of all remaining consumption has been determined and made available to the Executive Committee, and
- (d) Either no other possible activities would allow the country to meet its CFC control obligations, or the comparative consumer price of CFCs, relative to substitute refrigerants, has been high for at least nine months and is predicted to continue to increase.

2. At its 31st meeting, the Executive Committee decided that incentive programmes to encourage retrofitting could be submitted under decision 31/48. Subsequently, at the 32nd meeting, UNDP developed the concept of incentive programmes for retrofit/replacement of refrigeration equipment in the commercial and industrial end-user and submitted three projects, and the Executive Committee decided *inter alia* that project proposals for incentive programmes to encourage retrofitting of refrigeration equipment could be submitted within a refrigerant management plan (RMP) under certain conditions (decision 32/28).

3. Three years after the decisions taken by the Executive Committee at its 31st and 32nd meetings, an evaluation of the implementation of RMPs was conducted in 2003. The evaluation reported pilot tests on retrofitting domestic and small commercial appliances to hydrocarbons in several countries visited (Ghana, Senegal, Uruguay), which were seen as a potential option to continue operating CFC-based refrigerators with limited cost after the CFC phase-out. They required intensive safety training for technicians and adaptations of workshops, and claimed that the energy efficiency would improve, although this was not documented. Conversion of refrigerators to HFC-134a was found not economically viable in most cases due to its relative high cost, the cost of ester oil and difficulties in handling the system. Drop-in refrigerants were at the time considered worth exploring as useful transitional solutions.

4. The limited evidence collected on end-user conversions during this evaluation suggested again that incentive programmes could, in principle, be effective if the following elements were in place: 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 companies, and last but not least, economic growth which helped to mobilize public and private funds for modernization of investments. The evaluation also concluded that it was the anticipation of market developments and not awareness-raising that could induce the private sector to embark upon conversion of technologies, implying additional investments, and that further analysis of the factors for success was required.

5. By 2007, twenty refrigeration end-user incentive programmes had been approved and a subsequent desk study on incentive programmes for retrofits was undertaken. The study confirmed that it was possible and also essential for a country to meet the prerequisites established by the Executive Committee for the approval of incentive programmes - i.e.: production and import controls on CFCs and CFC-based

equipment in place and effectively enforced, coupled with restricted development of new CFC components. The study further confirmed that without these preconditions being in place, the necessary close cooperation with the potential beneficiaries was very difficult or impossible to realize, as some countries had experienced. Project delays observed in this evaluation were attributed primarily to the lack of necessary preconditions for the successful start of the incentive projects.¹

6. The study showed that a series of substitutes were considered in the end-user incentive programmes, including retrofitting to HCFC-22, HFC-134a, HFC-404A, HC, or dropping in refrigerant HFC-406, HFC-409 and C-10M1. The beneficiary enterprises from the incentive programme confirmed significant economic benefits derived from the conversion due to the lower price of HCFC-22 (in all the cases between 20 and 52 per cent of the price of CFC-12). In cases of conversion to HFC-134a or HFC-404A, owners of refrigeration equipment advised that even though the price per kilogram of new alternatives was currently higher than that of CFC-12, the economic benefits derived from the operational efficiency of the new systems far outweighed the differences in the prices of the refrigerants and should be an incentive for converting to new alternatives. Drop-in conversion using ternary blends containing HCFC had at the time limited applications in Article 5 countries due to their low availability and high cost, especially given the high leakage rate of aging refrigeration equipment. Almost all companies reported that refrigerant leakages and frequent breakdowns had been reduced or completely stopped, resulting in drastic reductions in operational expenses and in periodic losses of stored products.

7. Some of the factors that motivated the end-users to retrofit their equipment included a limited remaining lifetime of existing equipment and increased cost of maintenance; increase in the price of CFC-12 refrigerant and a comparatively low price of HCFC-22; increased awareness of owners regarding ODS phase-out and future shortage of CFC refrigerants; relatively simple procedures for accessing funds under the incentive programme; increased awareness about additional benefits resulting from conversion, such as energy savings, lower cost of maintenance, reduced leakages, and emerging business opportunities associated with better performance of the replaced or retrofitted refrigeration equipment. The retrofit of existing equipment resulted in the extension of its life span and the deferral of otherwise inevitable investments in equipment in the food processing industry; the availability of alternative technology and local contractors providing quality service for replacement and retrofit; and good connection of local consultants with servicing technicians and local refrigeration contractors through the national refrigeration association.

8. In 2009, the evaluation of terminal phase-out management plans concluded that incentive projects for retrofits worked well in places where CFC-12 prices were rising rapidly while the prices of equally available alternatives were stable. The evaluation further concluded that the price difference, the level of the incentive and the NOU-related activities also played a significant role.²

¹ UNEP/OzL.Pro/ExCom/52/18

² UNEP/OzL.Pro/ExCom/58/8

Annex II

REPORTS ON END-USERS RECEIVED FROM IMPLEMENTING AND BILATERAL AGENCIES

Group I End-user incentive schemes for conversion or replacement of HCFC-based equipment

#	Country	Implementing agency	Page
1.	Bhutan	UNDP	2
2.	Brunei Darussalam	UNDP	3
3.	Cambodia	UNDP	4
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8.	Madagascar	UNIDO	10
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12.	Sri Lanka	UNDP	15
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Group II Projects to demonstrate alternative technologies

1.	Chile	UNDP	17
2.	Ecuador	UNIDO	18-19
3.	Georgia	UNDP	20
4.	Grenada	UNEP	21-22
5.	Iran (Islamic Republic of)	Government of Germany	23
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Group III Leakage reduction programmes at end-users

1.	Brazil	Government of Germany	28-29
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Group I: End-user incentive schemes for conversion or replacement of HCFC-based equipment

PROJECT DESCRIPTION	
Country	Bhutan
Stage of the HPMP	HPMP (2011-2025)
Implementing agency	UNDP
Project title	HCFC phase-out management plan
Subsector/application	RAC/ domestic/commercial air-conditioning
Alternative technology	Capped to GWP-675 or lower
Number of beneficiaries planned	65
HCFC-22 to be phased out (mt)	232 Kgs
Funds approved (US \$)	US\$ 79,000
Co-funding commitment (US \$)	30% was funded from project and 70% was co-financed by the beneficiaries
Planned date of completion	Completed (December 2018)
Description: The objective of the replacement incentive programme was to support and promote zero ODP and low GWP appliances. 65 units of appliances were planned for conversion out of which: 60 appliances in domestic refrigeration and air conditioning and 5 in commercial sector.	
ACHIEVEMENTS AND IMPACT	
Number of beneficiaries assisted	2 (15 units)
HCFC-22 phased out (mt)	33 Kgs.
Co-funding provided (US \$)	USD 7,892
Actual date of completion	August 2018
Main results obtained and any other environmental/economic impact achieved: The programme has initiated after four workshops with stakeholders were carried out to promote it. There was reluctance from targeted audience to replace their existing R-22 based equipment due to timing and incompatibility with public budget. The NOU targeted private sector in order to maximize project outputs. In both cases, the initial planning from beneficiaries was to install R-22/R410A units (commercially available and less costly). Two institutions (The National Animal hospital in 2017 and the Samtse Higher Secondary School in 2018) were installed with fifteen R-32 based units' heat pump and AC. The potential direct emission reduction was 24,516 CO ₂ -eq (39,096 CO ₂ -eq from baseline equipment to 14,580 CO ₂ -eq for new units).	
Reasons for delay. If the project was discontinued, please explain the reasons and indicate to what activities the funding was reallocated: Although sensitized on this incentive scheme in various workshops, meetings and trainings, the stakeholders felt 25%-30% incentive was insufficient to motivate the change of technology. The cost of newer low GWP technologies are higher than the HFC-410A-based air conditioners (seen as most common replacement for R-22 units) and even higher when compared to R-22 units, with the cost differential superseding the 25-30% incentive level. There was an urgent need to revisit the national strategy. Further, the government wanted to strengthen Refrigeration & Air-conditioning course in Technical Education for sustaining the training outputs to reduce leakage. Keeping in mind the sustainability of future training, the 83 rd ExCom has approved the reallocation of unspent funds towards other component of training and procurement.	
REPLICABILITY AND SUSTAINABILITY	
Associated technical assistance/training provided	Workshops, awareness actions, information sharing and sensitization, as well information embedded in RAC training activities
Associated policies or regulatory measures planned/promulgated, if any	Yes, the government put a ban on imports of new air-conditioners with HCFC-22 under the HPMP.
Number of additional end-users that followed the same approach as a result of the project	N/A
Comments on the reasons for success of failure of the project and recommendations: Bhutan faces a challenging scenario in terms of market penetration of low GWP-based RAC equipment, since R-290A ACs are not available and are not offered by international suppliers, and current available HFC-32 units have a cost that supersede the 30% subsidy offered under the replacement programme, making not viable to implement a large-scale replacement programme in the very short term while no further restrictions over HFC-based equipment are legally possible to be put in place. Another reason is that there is current low penetration of HCFC-22 based air-conditioners used in the government buildings, therefore there is less need to change the air-conditioners at these end-users since they did not reach end-of-life yet, while further newer installation are based on HFCs units. In the face of recognizing these challenges, upon request from the Government of Bhutan, the MLF agreed the reallocation of USD 33,817 for use of remaining funds in training/R&R activities under the HPMP.	

PROJECT DESCRIPTION	
Country	Brunei Darussalam
Stage of the HPMP	HPMP I
Implementing agency	UNDP
Project title	HCFC Phase out Management Plan Stage I
Subsector/application	Residential AC and large RAC for phasing out HCFC based equipment
Alternative technology	Zero ODP Low GWP alternates (R32, R290)
Number of beneficiaries planned	35
HCFC-22 to be phased out (mt)	85 kg
Funds approved (US \$)	US\$ 33,500 (including incentive and awareness/capacity building workshops)
Co-funding commitment (US \$)	Up to 25% from HPMP Up to 75% co-funding
Planned date of completion	Dec 2020
Description: End user replacement programme is one the component under HPMP I of Brunei. The purpose is to demonstrate and share experience on replacing R-22 based equipment in RAC sector with zero-ODP and low-GWP alternatives, with the provision of incentive (up to 25% of the cost). The activities include awareness and capacity building workshops for stakeholders (users, technicians, importers, decision makers etc.) in addition to implementation of replacement programme.	
ACHIEVEMENTS AND IMPACT	
Number of beneficiaries assisted	n/a
HCFC-22 phased out (mt)	n/a
Co-funding provided (US \$)	n/a
Actual date of completion	ongoing
Main results obtained and any other environmental/economic impact achieved: The activity has been initiated. Stakeholder meetings were conducted, however, the alternates (non-ODP, Low-GWP) identified as suitable for the sectors are mildly flammable/flammable. As per country's law, NOU requires approval of the relevant authorities to introduce these A2I/A3 refrigerants in the country. NOU is following up and still awaiting approval of relevant government agencies for allowing use of flammable refrigerants as required. The meetings are held by NOU with these relevant government agencies.	
Reasons for delay. If the project was discontinued, please explain the reasons and indicate to what activities the funding was reallocated: As above	
REPLICABILITY AND SUSTAINABILITY	
Associated technical assistance/training provided	Awareness workshops and technical workshops is being conducted for alternate technology about benefits of energy efficiency
Associated policies or regulatory measures planned/promulgated, if any	Additional Policy allowing approval of fire department for allowing use of flammable refrigerant in RAC applications
Number of additional end-users that followed the same approach as a result of the project	On going
Comments on the reasons for success of failure of the project and recommendations: This component of HPMP I is yet under implementation stage. However, learning is to ensure that policy mechanism is in place while considering alternate technology.	

PROJECT DESCRIPTION	
Country	Cambodia
Stage of the HPMP	HPMP (single stage up to 2030)
Implementing agency	UNDP
Project title	HCFC phase-out management plan
Subsector/application	Residential air conditioning
Alternative technology	R-32, R-290
Number of beneficiaries planned	900
HCFC-22 to be phased out (mt)	1,800 kg
Funds approved (US \$)	USD 350,000 (includes awareness workshops and technical workshops for stakeholders in addition to incentive for replacement programme)
Co-funding commitment (US \$)	25% would be incentive for low GWP equipment. Balance 75% will be borne by the beneficiaries
Planned date of completion	Dec 2024 (as proposed in fourth tranche request) – HPMP Project ends in 2030
Description: to demonstrate and share experience on replacing R-22 based refrigeration equipment in RAC sector with zero-ODP and low-GWP alternatives. The activity will include creating awareness in users for alternate technology. Technical workshops for technicians about the replacement programme and implementation of replacement programme.	
ACHIEVEMENTS AND IMPACT	
Number of beneficiaries assisted	69 as of July 2019 – ongoing
HCFC-22 phased out (mt)	138 kg
Co-funding provided (US \$)	n/a.
Actual date of completion	Ongoing
Main results obtained and any other environmental/economic impact achieved: HFC-32 units were introduced into the domestic market giving opportunity for Cambodia to implement the replacement programme vis-à-vis with the market penetration of the climate-friendly technology. Training/awareness to technicians/suppliers/users about non-ODS low GWP technology were implemented in order to ensure that replacement incentive programme is received well by the country. Many awareness workshops for different stakeholder groups (users, technicians, importers) had to be conducted to create awareness/capacity building for penetrating low GWP alternatives. The programme has received good response from the users. The quantity of replacements is increasing. NOU has been visiting beneficiaries that have replaced their air conditioners for monitoring purposes. Initial feedback from the users found high rates of satisfaction with the program. The programme is ongoing.	
Reasons for delay. If the project was discontinued, please explain the reasons and indicate to what activities the funding was reallocated: n/a	
REPLICABILITY AND SUSTAINABILITY	
Associated technical assistance/training provided	In addition to awareness workshops, several training workshops were organized during the project period to train technicians on alternate technology. In 2015, HFC-32 and HC-290 were not yet commercially available in Cambodia's domestic market. MOE worked closely with technical experts, service agencies and implementing agencies on identification of feasible options for adoption. Also, in the meantime, MOE continued organizing awareness activities and capacity building for technicians for new technologies.
Associated policies or regulatory measures planned/promulgated, if any	Ban of imports of HCFCs-based equipment from 2020.
Number of additional end-users that followed the same approach as a result of the project	No specific study done. The replacement incentive programme is still ongoing.
Comments on the reasons for success of failure of the project and recommendations: Project ongoing.	

PROJECT DESCRIPTION	
Country	Croatia
Stage of the HPMP	Stage I
Implementing agency	UNIDO
Project title	HCFC Phase-out Management Plan
Subsector/application	Retrofit/replacement of HCFC-22 chillers/industrial/commercial refrigeration installations
Alternative technology	Retrofit to HFCs, replacement to natural alternatives
Number of beneficiaries planned	At least three (3) sites retrofitted to the use of alternative refrigerants with zero ODP; At least seven (7) sites converted to the use of refrigerants with low GWP, like CO ₂ , ammonia or hydrocarbons.
HCFC-22 to be phased out (mt)	0.89
Funds approved (US \$)	360,000
Co-funding commitment (US \$)	About US\$ 690,000
Planned date of completion	Completed December 2015
Description: This component shall be used as a promotion of low GWP alternatives and new technologies. In this case, it is of particular interest to support some demonstration retrofit projects of non-HFC, low-GWP technologies, such as hydrocarbon (R290, R1270), carbon dioxide (R744) and ammonia (R717) with applications in supermarket refrigeration, chiller installations and heat pump systems. In the Republic of Croatia there are a number of water chillers that contain and consume high quantities of HCFC-22 refrigerant. Insufficient funding for maintenance and service activities is the major cause of their poor condition. In order to decrease the HCFC-22 consumption and at the same time to increase energy efficiency and lower the GWP impact of existing systems, it is recommended to replace the largest, state-owned HCFC-22 systems, e.g. public hospitals, ministerial premises, etc. in the Republic of Croatia.	
ACHIEVEMENTS AND IMPACT	
Number of beneficiaries assisted	32
HCFC-22 phased out (mt)	2,224 (installed capacity)
Co-funding provided (US \$)	Approximately US\$ 870,000
Actual date of completion	December 2015
Main results obtained and any other environmental/economic impact achieved: 22 retrofits to HFCs – (1,502 kg) 7 conversions to propane and 3 conversions to ammonia (722 kg) Annual saving of 4,472,110 kg CO ₂ eq	
Reasons for delay. If the project was discontinued, please explain the reasons and indicate to what activities the funding was reallocated: Not applicable	
REPLICABILITY AND SUSTAINABILITY	
Associated technical assistance/training provided	Not as part of the incentive programme, but as separate HPMP component.
Associated policies or regulatory measures planned/promulgated, if any	Adoption of EU regulations
Number of additional end-users that followed the same approach as a result of the project	All HCFC-users, since after entry to the EU, Croatia had to comply with EU regulations.
Comments on the reasons for success of failure of the project and recommendations: The project was successful due to the legal obligations of phasing-out HCFCs ahead of the original schedule and the significantly increased HCFC prices, as well the availability of the environmental fund to support retrofits and conversions.	

PROJECT DESCRIPTION	
Country	Cuba
Stage of the HPMP	HPMP (2011-2020)
Implementing agency	UNDP
Project title	HCFC phase-out management plan Stage 1
Subsector/application	RAC/ Commercial /Commercial refrigeration
Alternative technology	Non established.
Number of beneficiaries planned	500
HCFC-22 to be phased out (mt)	2.85 mt (for all activities in the refrigeration sector).
Funds approved (US \$)	350,000
Co-funding commitment (US \$)	
Planned date of completion	On-going (December 2020)
Description: The project aimed to provide technical assistance and co-financing to a determined number of commercial refrigeration users to convert and update their HCFC-based refrigeration system to ODS-free technologies. Conversion is structured in different levels, from replacing the condensing units, the compressors and controls to changing the refrigerant and oils. The type of equipment converted is commercial refrigeration units, medium size, located in stores (such as cold rooms); The converted equipment used HCFC-22 as refrigerant, with high leakage rate and high energy consumption. These two problems were solved with the conversion to R-404A. When the NOU designed this activity within the HPMP, it analyzed different alternatives for the selection of the refrigerant, at the end R-404A was selected due to availability, cost, and technical knowledge; other alternatives were either more expensive, with higher GWP or not available in the country.	
ACHIEVEMENTS AND IMPACT	
Number of beneficiaries assisted	715
HCFC-22 phased out (mt)	Not available.
Co-funding provided (US \$)	Not available.
Actual date of completion	On going (December 2020).
Main results obtained and any other environmental/economic impact achieved: The project supported the introduction of an ODS-free technology in 715 RAC systems while helping to improve the energy efficiency, to reduce the refrigerant leaks and to improve the reliability of the RAC systems. All these effects translate in savings for the owner of the equipment and increased “on-time” of the equipment which translated in fewer lost of goods. Also, OTOZ promoted among RAC technicians criteria for evaluating the RAC systems to determine if conversion was a cost-effective option.	
Reasons for delay. If the project was discontinued, please explain the reasons and indicate to what activities the funding was reallocated: There were not delays in the implementation of the project. Other alternatives with lower GWP were not available in the country or were not cost-effective, this lack of alternatives could be considered a constrain for the implementation of the project.	
REPLICABILITY AND SUSTAINABILITY	
Associated technical assistance/training provided	Workshops, awareness actions, information sharing and sensitization on alternatives technologies for the supermarket sector, mainly transcritical CO2.
Associated policies or regulatory measures planned/promulgated, if any	N/A.
Number of additional end-users that followed the same approach as a result of the project	N/A
Comments on the reasons for success or failure of the project and recommendations: Considering that the Kigali Amendment was approved and that the country is in process of its ratification, OTOZ is analyzing possible alternatives with lower GWP to replace the introduction of R-404A. Finding a suitable alternative will be key for the continuation of the project. Nevertheless, the technical assistance given and the criteria thought to the RAC technicians are key elements to support the replicability and sustainability of the conversion to ODS-free technologies. The improvements in the performance of the equipment and the generated operational savings are used to promote the conversion to new refrigerants.	

PROJECT DESCRIPTION	
Country	Fiji
Stage of the HPMP	HPMP I
Implementing agency	UNDP
Project title	HCFC Phase out Management Plan Stage I
Subsector/application	Residential AC and large RAC (including fishery)
Alternative technology	Non ODS Low GWP alternates
Number of beneficiaries planned	33
HCFC-22 to be phased out (mt)	120 kg
Funds approved (US \$)	US\$ 48,500 (including incentive and awareness/capacity building workshops)
Co-funding commitment (US \$)	Up to 25% incentive would be provided for replacement incentive programme Up to 25% as co-funding
Planned date of completion	December 2020
Description: The activities in the HPMP were designed to address three strategic elements crucial to the successful phase-out of HCFCs in the country, namely: reducing the dependence on HCFCs and HCFC-based equipment through limiting supply, promoting HCFC-free-based alternatives to HCFC-based equipment and reducing demand for HCFCs in existing equipment. End-user incentive programme is one of the important part of HPMP I which supports promoting HCFC Free alternatives to reduce demand of HCFCs. The purpose is to demonstrate and share experience on replacing R-22 in RAC sector with zero-ODP and low-GWP alternatives, with the provision of incentive (up to 25% of the cost). The activity also includes awareness workshops for stakeholders, technical workshops for capacity building of technicians in addition to implementation of replacement programme.	
ACHIEVEMENTS AND IMPACT	
Number of beneficiaries assisted	Ongoing
HCFC-22 phased out (mt)	-
Co-funding provided (US \$)	-
Actual date of completion	NA
Main results obtained and any other environmental/economic impact achieved: Several consultation meetings on replacement options and incentive schemes with the residential air-conditioning and fishing vessel sectors were organized. A scheme for implementing end-user incentive programme for residential ACs was designed. Meetings were held with relevant stakeholders. It is noted that R32 is introduced in the market and this end user incentive programme will support penetration of this low-GWP alternative.	
Reasons for delay. The incentive programme is delayed mainly for the fishery sector, most vessels are second hand and already reached age of 25-35 years. Due to this, there are frequent issues of leakage and maintenance. Till now, there is no suitable viable alternative that can be applicable to the aged vessels (matching factors of investment required, payback period, and A1 alternatives with acceptable lower GWP than current HCFCs). A study is being done by the government to assess the situation, since fishery sector is critical in growing economy of Fiji, it is very important for department of Environment to work out a solution for this sector. The awareness is already there in the sector about HCFC phase out. NOU along with UNDP is working to find out various options. The residential AC incentive programme will be implemented soon.	
REPLICABILITY AND SUSTAINABILITY	
Associated technical assistance/training provided	Several training programme for technicians were conducted on alternate technology including HC, R32 and R290 to assist the industry in transiting to non-ODS and low GWP refrigerant.
Associated policies or regulatory measures planned/promulgated, if any	Fiji currently regulates the ODS through Act 1998 and the ODS Regulations 2010 which regulates the use of ODS and Equipment charged with ODS
Number of additional end-users that followed the same approach as a result of the project	n/a.
Comments on the reasons for success of failure of the project and recommendations: Overall, though replacement programme is still ongoing, the awareness and technical assistance activities allowed to spread awareness about alternatives and also gave exposure to main stakeholders to understand options and its pros and cons. The important lesson is that alternatives for the domestic RAC sector exists and can become viable at the country, however for fishery sector, more efforts will be required, due to the unavailability of a suitable alternate A1 refrigerant (uncertainty of performance of alternate refrigerant, safety, costs etc.). Second hand old vessels of Fiji are most vulnerable to the HPMP activities. Meetings were organized with the fisheries sector stakeholders to assess the need and way forward for implementing replacement programme in Fiji. The meeting also initiated a technical working group / stakeholder working group which will focus on replacement programme related issues to find ways to move forward.	

PROJECT DESCRIPTION																				
Country	Ghana																			
Stage of the HPMP	Stage I																			
Implementing agency	UNDP																			
Project title	END-USER INCENTIVE PROGRAMME (EUIP)																			
Subsector/application	COMMERCIAL REFRIGERATION SERVICING (Cold Stores)																			
Alternative technology	RETROFITTING/CONVERSION FROM HCFC-22 TO A NON-ODS (in first 4 cases, R407C was selected as transitional refrigerant).																			
Number of beneficiaries planned	Ca. 13 to 15 beneficiaries in total expected at HPMP approval, but only four of them have been covered by the project as of today.																			
HCFC-22 to be phased out (mt)	1.246																			
Funds approved (US \$)	38,000 USD have been provided to the 4 first companies.																			
Co-funding commitment (US \$)	160,296 USD from the four companies that have completed the project.																			
Planned date of completion	June 2020																			
<p>Description: These were facilities that were running on R22 until the HPMP assisted the beneficiaries to retrofit their facilities to run on (HFC) R-407C. In addition to the refrigeration systems, the retrofits included improvements of the existing electrical installations for maximum safety and efficiency. Safety precautions including personal protective clothing and storage techniques, such as First-in-First-Out (FIFO) & Last-In First-Out (LIFO) were also provided.</p> <p>The modality for the incentive was based on the initial HCFC-22 refrigerant charged into the system, inspection of facilities and vetting and approval of application by the National Committee on ODSs (NACODS). Advertisements were made in the print and electronic media for the general public to buy into the programme. Beneficiary companies were required to sign contracts with Ghana EPA and provide bank guarantees of financial solvency and operational sustainability. Payments were made in two installments. First 60% installment was paid upon signing of contract and 40% after the completion with a verification report among others.</p>																				
<table border="1"> <thead> <tr> <th>COMPANY</th> <th>PROJECT FUND (USD)</th> <th>CO-FINANCED (USD)</th> </tr> </thead> <tbody> <tr> <td>Home Support Cold Store</td> <td>8,000</td> <td>30,823.23</td> </tr> <tr> <td>BroadWater Co. Ltd</td> <td>11,000</td> <td>39,139.30</td> </tr> <tr> <td>Charlie Boy Ent.</td> <td>11,000</td> <td>51,709.22</td> </tr> <tr> <td>Bajejo</td> <td>8,000</td> <td>38,624.18</td> </tr> <tr> <td>TOTAL</td> <td>38,000</td> <td>160,295.93</td> </tr> </tbody> </table>			COMPANY	PROJECT FUND (USD)	CO-FINANCED (USD)	Home Support Cold Store	8,000	30,823.23	BroadWater Co. Ltd	11,000	39,139.30	Charlie Boy Ent.	11,000	51,709.22	Bajejo	8,000	38,624.18	TOTAL	38,000	160,295.93
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TOTAL	38,000	160,295.93																		
ACHIEVEMENTS AND IMPACT																				
Number of beneficiaries assisted	Four (initial group)																			
HCFC-22 phased out (mt)	0.46																			
Co-funding provided (US \$)	160,296																			
Actual date of completion	20 th Sep. 2017 (Completion by initial group of 4 beneficiaries)																			
<p>Main results obtained and any other environmental/economic impact achieved:</p> <p>The retrofitted facilities are currently running on R-407C which has zero ODP and better energy efficiency (with a GWP of 1774). The retrofits were performed using safety and technical guidance to ensure safe and efficient operations of the facilities and have been well accepted by the beneficiaries. This HFC blend is being used as transitional refrigerant pending final replacement with zero- or low-GWP refrigerant. It also provides better cold storage temperatures thus providing better quality frozen foods in the cold rooms. The operatives have been trained in the code of good refrigeration practices and have acquired better maintenance culture. Unwanted emissions and leakages of the refrigerant have been prevented leading to refrigerant savings and mitigation of adverse environmental impact on the ozone layer and climate.</p>																				
<p>Reasons for delay. If the project was discontinued, please explain the reasons and indicate to what activities the funding was reallocated:</p> <p>The initial four beneficiaries completed retrofitting their facilities in 2017. However, due to the decision against the use of high-GWP HFCs as alternatives to HCFC-22 the implementation of the programme for the next group of nine companies was suspended. With resources currently available from the EUIP programme it is intended to take some initiatives imminently to address the issues of low-GWP technologies and their market availability in order to restart the programme. This is intended to be achieved through cooperation and assistance of the IAs (UNDP and Italy) and external institutions, such as the Centro Studi Galileo of Italy (which has expressed interest) in organizing relevant seminar/workshop for stakeholders and technical fact-finding visits by a selected national refrigeration expert to facilities and suppliers abroad to facilitate quicker transition to appropriate alternatives.</p>																				
REPLICABILITY AND SUSTAINABILITY																				
Associated technical assistance/training provided	The technicians manning the facilities were retrained on routine and running maintenance of the facilities based on good refrigeration servicing practices. It is expected that the trained technicians, especially workshop foremen will in turn train other operatives on the job. The NOU keeps monitoring the facilities. Additionally,																			

PROJECT DESCRIPTION	
Country	Ghana
	the three Ghanaian special refrigeration training centres established with MLF support are made accessible to practicing technicians for regular refresher training.
Associated policies or regulatory measures planned/promulgated, if any	The underpinning strategy of the Ghana HPMP is transition from ODS-based refrigerants to alternative natural refrigerants to the extent possible and low-GWP refrigerants as they become available and economically viable for end-users. Policies and regulatory measures taken as part of the implementation of the HPMP have driven the widespread use of R-600a as alternative to CFC-12 and HFC-134a in the domestic refrigeration sector, while R-290-based air conditioners and R-290 as alternative refrigerant for HCFC-22 are gaining market acceptability. The Ghana EPA intends to organize focused workshops to address the issues of low-GWP alternatives for the RAC servicing sector in general and in the commercial refrigeration sub-sector in particular in line with ExCom Decision 84/48 (b) and (c).
Number of additional end-users that followed the same approach as a result of the project	Given the appropriate conditions of availability of alternative technology the remaining identified nine companies could follow the same approach as result of the success story from the first four beneficiaries. However, unless the alternatives proposed are ozone- and climate-friendly, the funding from the Multilateral Fund would not be provided.
<p>Comments on the reasons for success of failure of the project and recommendations:</p> <p>The Ghana EPA advocacy was well received by the beneficiaries which provided leverage for companies to contribute on average a co-financing of 4 to 1 to the MLF funding. The tangible operational and economic advantages derived from the project generated interest among other stakeholders to participate in the programme.</p> <p>UNDP and Italy are supporting Ghana to explore the opportunity for the low-GWP alternatives. Please note that due to the potentially higher costs, the beneficiaries might be limited.</p> <p>For LVC Article 5 countries, the low consumption volumes of refrigerants usually militate against early market penetration of more environmentally acceptable refrigerants on markets available elsewhere; this is due to high costs. In order to facilitate the market uptake of the low-GWP alternative, LVCs need more funding from the MLF to provide the incentives. Current budget may be insufficient to carry out the incentive programme using the alternatives such as CO₂, Ammonia, R290, HFOs.</p>	

PROJECT DESCRIPTION	
Country	Madagascar
Stage of the HPMP	Stage I
Implementing agency	UNEP/UNIDO
Project title	- Project title: HCFC phase-out management plan - Activity title: Replacement scheme aiming to facilitate the replacement of HCFC-based air-conditioners to low-GWP alternative
Subsector/application	- Project subsector/application: servicing sector - Activity subsector/application: replacement of 38 HCFC-22-based air-conditioners (12,000 BTU cooling capacity) by R-290-based air-conditioners (18,000 BTU cooling capacity)
Alternative technology	Natural refrigerant (propane, R-290)
Number of beneficiaries planned	6 Facilities
HCFC-22 to be phased out (mt)	0.154 (ODS 2.8)
Funds approved (US \$)	USD 120,000 (incl. training, purchase and distribution of equipment for installation and maintenance of the R-290-based air-conditioners)
Co-funding commitment (US \$)	The beneficiaries will have to provide inland transportation for the equipment and install the R-290-based air-conditioners.
Planned date of completion	May 2020
Description: Facilities were identified to benefit from the financial incentive scheme aiming to facilitate the replacement of HCFC-based air-conditioners with low-GWP alternatives. The beneficiaries will have to provide inland transportation for the equipment and install them. UNIDO will provide technical support during the installation process. A supplier in a position to deliver the required air-conditioners was identified and commercial contract was established. The procurement process is ongoing and is expected to be completed during the course of 2019. The planned payment of incentives to commercial facilities to convert refrigeration systems from HCFC-22 to low-GWP alternatives was replaced by a replacement scheme expanded to more buildings due to inadequate funding for the refrigeration conversion after closer survey of proposed beneficiaries.	
ACHIEVEMENTS AND IMPACT	
Number of beneficiaries assisted	Project is ongoing
HCFC-22 phased out (mt)	Project is ongoing
Co-funding provided (US \$)	Project is ongoing
Actual date of completion	Project is ongoing
Main results obtained and any other environmental/economic impact achieved: Project is ongoing	
Reasons for delay. If the project was discontinued, please explain the reasons and indicate to what activities the funding was reallocated: Project is ongoing	
REPLICABILITY AND SUSTAINABILITY	
Associated technical assistance/training provided	Project is ongoing
Associated policies or regulatory measures planned/promulgated, if any	N/A
Number of additional end-users that followed the same approach as a result of the project	Project is ongoing
Comments on the reasons for success of failure of the project and recommendations: Project is ongoing	

PROJECT DESCRIPTION	
Country	Malaysia
Stage of the HPMP	HPMP I
Implementing agency	UNDP
Project title	Pilot retrofitting/replacement programme for end-users
Subsector/application	Residential and commercial RAC sector
Alternative technology	Zero ODP Low GWP alternates
Number of beneficiaries planned	Two large users in the air-conditioning and two large users in the refrigeration sector
HCFC-22 to be phased out (mt)	Not established
Funds approved (US \$)	US\$ 98,000 (including awareness and technical assistance)
Co-funding commitment (US \$)	1:1 ratio
Planned date of completion	Dec 2017
Description: Pilot retrofitting/replacement programme for end-users was aimed to replace HCFC-based equipment in the domestic and commercial RAC sector to demonstrate, build confidence in other end-users, precipitate early replacement in other end-users, and reduce HCFC demand for servicing equipment at end-users.	
ACHIEVEMENTS AND IMPACT	
Number of beneficiaries assisted	82 domestic air conditioning and one commercial refrigeration
HCFC-22 phased out (mt)	203 kg
Co-funding provided (US \$)	US\$ 110,000 by beneficiary
Actual date of completion	April 2017
Main results obtained and any other environmental/economic impact achieved: As approved for third tranche request (75 th ExCom): (1) it was decided that rather than promoting retrofit, country would replace around 100 small-size HCFC-22-based air-conditioning units for HFC-32-based units (retrofit that time to low-GWP efficient retrofit technologies were not recommended). (2) Reallocation of the fund balance leading to US \$162,952 for supporting pilot incentive programme for replacement of HCFC-22 equipment with alternatives to industrial and commercial refrigeration (e.g., ammonia-based systems and CO ₂ -based systems). Pilot retrofitting/replacement programme for end-users was one of the activities under HPMP I. Replacement project at Jaya Grocer with CO ₂ was completed in April 2016 with support from Panasonic, Japan. Replacement project of HCFC-22 air conditioners with HFC-32 air conditioners was completed in July 2016 at two demonstration sites (University Kuala Lumpur - 16 units; Environmental Institute of Malaysia - 66 units). Both the replacement programme were well received by the stakeholders. It allowed the market transformation for residential air conditioning with the field demonstration of safety and efficiency of the units deployed.	
Reasons for delay. If the project was discontinued, please explain the reasons and indicate to what activities the funding was reallocated: The commercial refrigeration replacement project was delayed by 3-4 months due to difficulty in identifying technology providers in Malaysia and the beneficiary willing to provide co-funding required. Several meetings were organized by NOU with supplier and beneficiary and finally the management of Jaya Grocer agreed to co-fund the replacement of old R-22 system.	
REPLICABILITY AND SUSTAINABILITY	
Associated technical assistance/training provided	Throughout the project period, many awareness programme for users/technician were carried out to create awareness/capacity building for alternate technology.
Associated policies or regulatory measures planned/promulgated, if any	A ban on the establishment and expansion of new HCFC-based manufacturing capacities as of 1 January 2013 was issued. Malaysia will also issue ban on the import of RAC equipment operated with HCFCs and on the manufacturing and new installation of RAC equipment operating with HCFCs by 1 Jan 2020.
Number of additional end-users that followed the same approach as a result of the project	No dedicated monitoring funds were allocated further than collect the project immediate results.
Comments on the reasons for success of failure of the project and recommendations: The activities related to replacement programme under the HPMP were implemented successfully with active support, participation and cooperation of the NOU and critical stakeholders. The collaboration between NOU, Supplier, beneficiaries and UNDP helped effective implementation. The awareness and technical training also has a big role to play for any such replacement programme.	

PROJECT DESCRIPTION	
Country	Maldives
Stage of the HPMP	HPMP (2011-2020)
Implementing agency	UNDP (co-op IA)
Project title	HCFC phase-out management plan
Subsector/application	RAC domestic air-conditioning and Fisheries
Alternative technology	R-32 for domestic air-conditioners and R-438A for large commercial and industrial refrigeration end-users
Number of beneficiaries planned	750 residential units 15 commercials units
HCFC-22 to be phased out (mt)	1,650 Kgs residential (includes maintenance) 300 Kgs. Commercial (includes maintenance)
Funds approved (US \$)	US\$ 220,000 (includes TA for workshops, experts and documentation)
Co-funding commitment (US \$)	In large systems, US\$ 70,443 and In small appliances, it is being 35% was funded from project and 65% was co-financed by the beneficiaries (final figures at the completions of the project)
Planned date of completion	November 2020
Description: The objective of the replacement incentive programme was to support and promote zero ODP and low GWP appliances. 765 units of appliances were planned: 750 appliances in domestic refrigeration and air conditioning and 15 in large commercial and industrial refrigeration sector.	
ACHIEVEMENTS AND IMPACT	
Number of beneficiaries assisted	Four end-users supported: 15 units of commercial RAC system. One end-user supported: 135 units of air-conditioners
HCFC-22 phased out (mt)	1,497 Kgs in total: 297 Kgs. from air conditioners and 1,200 Kgs. from commercial retrofitting
Co-funding provided (US \$)	Co-financing for the R 438A conversion by beneficiaries – 70,422.80 USD Co-financing for the R-32 conversion by beneficiary – 299,000 USD (on-going)
Actual date of completion	The project is on-going
Main results obtained and any other environmental/economic impact achieved: This activity was carried out through organizing four consultative workshops with government and private partners. The activity was divided into two groups: (a) large commercial and industrial refrigeration end-users (inc. Fisheries Sector); and (b) Domestic air-conditioning: <ul style="list-style-type: none"> • In fisheries sector, total 1,200 kgs of R-22 was eliminated by four beneficiaries, where 15 large units were replaced (project’s target accomplished). • In domestic air-conditioning, a series of workshops were held from 2014-2017 to aware the beneficiaries and on alternative technologies, but penetration of low-GWP units were still very incipient and no further replacement action could take place. In 2017, a technology roadshow was organized to promote R-32, R-290, Ammonia and CO2 alternatives. It was noticed during technology road show that the price of R-410A units offered by importers was lower than R-32 and R-290 based air-conditioners, but with additional benefits of having similar COPs but easier handling (no flammable, wide range of parts for maintenance), which constituted another barrier. The tourism sector (resorts) showed interest in engage into a large programme, however because of the competitive scenario for HFC-32, the project could not go on with these stakeholders. In this regard, after thorough market analysis, the Ministry (MIFCO) took the lead on the incentive programme and replaced approximately 135 air-conditioners of different capacity with R-32 to “open the market” for the technology and holding the higher cost opportunity for the transition. Current, almost same quantity of ACs are being procured under the replacement incentive scheme. MIFCO is keen on deliver further support especially for the fisheries sector (critical for Maldives), where another six vessels are interested in retrofit/replacement, however only viable alternative would be R-448A, which currently is not incentivized as per discussions held at MLF level for the Demonstration Project. 	
Reasons for delay. If the project was discontinued, please explain the reasons and indicate to what activities the funding was reallocated: The project was delayed due to non-availability of best alternatives in the Asian market. The alternate came into the market was R-438A, which was used by the beneficiaries, however MLF conveyed that the usage of R438A should not be encouraged due to high GWP.	
REPLICABILITY AND SUSTAINABILITY	
Associated technical assistance/training provided	All the technicians of the companies involved were given training. In the case of fishery vessels, specific trainings were provided. Some of the areas covered during the trainings include;

PROJECT DESCRIPTION	
Country	Maldives
	<ul style="list-style-type: none"> - Good practices in retrofitting - Fundamental of refrigeration and air-conditioning - Alternatives to R 22 - Good servicing practices in handling flammable refrigerants
Associated policies or regulatory measures planned/promulgated, if any	<p>HCFC import/export controls imposed as per the new Ozone Layer Protection Act, 2015, and the Government of Maldives has introduced tax incentives for HCFC alternatives and disincentives for HCFCs through its Import and Export Act.</p> <p>For ammonia, the import tax reduced from 10% to 5% to provide incentive for adoption of low GWP alternatives. For HCFCs and blends, the import tax was increased from 10% to 100%.</p>
Number of additional end-users that followed the same approach as a result of the project	Horizon Fisheries, a private fisheries complex has converted all their equipment to non-HCFCs with their own funding after the retrofit programme. The company has reduced from 2,202 kg of HCFCs.
<p>Comments on the reasons for success of failure of the project and recommendations:</p> <ul style="list-style-type: none"> • Fishery sector is critical in terms of technology selection. Social and environmental factors must be balanced when deciding the technology change (in many cases, it is not feasible to push the change of the vessel for a new one that is fully adapted for toxic/flammable alternatives due to extreme higher costs when issues related to return rate, profitable, investment capacity of the owner are not feasible). In this regard, the lifetime of current vessels must be considered and some flexibility in the technology change should be allowed to assure compliance with the HCFCs phase-out schedule. • Market penetration of low-GWP alternatives is critical! Ample time should be given in search of and for test run of new refrigerants. Countries that are “technology takers” suffer the double as the low GWP alternatives will take much longer to be available at competitive costs. Training is also critical to assure that proper installation and maintenance is given. Aftermarket parts are also critical to assure sustainability. • In all workshops and consultations, the message given by stakeholders is that “All the end users should be comfortable with the new refrigerant” 	

PROJECT DESCRIPTION	
Country	Nepal
Stage of the HPMP	HPMP Stage I (2012-2020)
Implementing agency	UNDP (co-op. IA)
Project title	HCFC phase-out management plan
Subsector/application	RAC/ domestic air-conditioning / commercial/industrial refrigeration and air-conditioning
Alternative technology	R-32 (No ODP, GWP-675) and/or low GWP
Number of beneficiaries planned	18 beneficiaries planned. (15 domestic air-conditioning, and 3 for large commercial/ industrial refrigeration)
HCFC-22 to be phased out (mt)	153 Kgs planned. (including charge amount and servicing sector needs)
Funds approved (US \$)	US\$ 36,000
Co-funding commitment (US \$)	35% funded from project; 65% was co-financed by the beneficiaries
Planned date of completion	December 2020.
Description: The objective of the replacement incentive programme is to support and promote zero ODP and low GWP appliances in domestic refrigeration and air conditioning and in commercial sector.	
ACHIEVEMENTS AND IMPACT	
Number of beneficiaries assisted	24 (as of 31 July 2019)
HCFC-22 phased out (mt)	75 Kgs.
Co-funding provided (US \$)	USD 111,607
Actual date of completion	On-going
Main results obtained and any other environmental/economic impact achieved: Three meetings with government stakeholders and two workshops with multi-stakeholders were organized to promote this activity. A public call notice was published twice in newspaper to seek for interested end-users. The government could get very low response from the public calls and it was believe that due to public's lack of interest for (i) relative higher cost of alternative equipment and; (ii) need to go over screening and legal process to engage into programme. The government obtained support from equipment distributors, this was critical to establish a route to channel the incentives and facilitate access of end-user, since the customer can access the distributor of his/her trust to obtain technical and commercial support on the replacement. The distributor is responsible to complete all legal and bureaucratic steps on behalf of the end-user, the application is submitted to the Government whom will (or not) approve the incentive to be release. The NOU staff will verify the documents and approve the funds. This approach has worked very successful. Up to now, 34 installations were completed. On the monitoring side, the NOU undertake verification of installations based on sampling approach, also interacting with the end-user to assess the implementation performance of the project, and so far, no issues were raised by the end-users.	
Reasons for delay. If the project was discontinued, please explain the reasons and indicate to what activities the funding was reallocated: The project has faced some initial delays due to a confluence of issues: change of the National Ozone Officer and Assistant, the earthquake that hit Nepal requesting change of priorities from GOV and private sector and the lack of R-32 based units in the market at competitive costs with other high-GWP alternatives. Initial issues were resolved and since 2018 project is in full implementation, has already surpassed initial target, it is considered that there is a high demand of end-users seeking for support.	
REPLICABILITY AND SUSTAINABILITY	
Associated technical assistance/training provided	stakeholders workshop looked to sensitize target audience on the benefits of the alternate technologies. The distributors were training and are replicating energy savings approach to increase impact. Lower emissions, and no ODP features are also being informed.
Associated policies or regulatory measures planned/promulgated, if any	Yes, the government put a ban on new air-conditioners with HCFC-22.
Number of additional end-users that followed the same approach as a result of the project	Not available
Comments on the reasons for success or failure of the project and recommendations: Despite the challenges faced in the beginning, the project has gained its momentum is demonstrating to be successful. Project is still ongoing.	

PROJECT DESCRIPTION	
Country	Sri Lanka
Stage of the HPMP	Stage I
Implementing agency	UNDP
Project title	HCFC Phase-out Management Plan
Subsector/application	Air-conditioners (Domestic air-conditioning up to 2 TR capacity)
Alternative technology	R-32 or other low GWP technology
Number of beneficiaries planned	204 (domestic and commercial)
HCFC-22 to be phased out (mt)	520 kg (including charge amount and servicing sector needs)
Funds approved (US \$)	60,866 (requested funds were US\$137,000; however, the approval was of US\$ 60,866) It includes replacement and TA activities.
Co-funding commitment (US \$)	Incentive payment depend on the cooling capacity was paid to end user and balance cost of the Air Conditioner was borne by the end user. Approximately 15-25% from the project and 75-85% by the beneficiary.
Planned date of completion	December 2020
Description: Objective of this project was to encourage purchasing of new technology domestic Air Conditioners working on zero ODP, Low GWP refrigerant such as R 32 or R 290. It was related to new purchase and majority as replacement of old ACs worked on R-22. Modality of incentive paid for a unit of AC was as follows: 9,000 Btu/h – US\$ 120; 12,000 Btu/h -US\$ 150, 18,000 Btu/h – US\$ 200, 24,000 Btu/h – US\$ 250	
ACHIEVEMENTS AND IMPACT	
Number of beneficiaries assisted	199 (as of 31 July 2019)
HCFC-22 phased out (mt)	520 Kg of HCFC-22 eliminated
Co-funding provided (US \$)	166,410
Actual date of completion	Project ongoing.
Main results obtained and any other environmental/economic impact achieved: The project has not yet been completed. Preliminary results are showing that the Sri Lankan Government is being able to promote R-32 as a suitable replacement for installations that current work or aim to on R-22. A strong awareness programme was put in place so general public could be aware of low GWP alternative technologies available in the country. Based on the incentives, customers have opted for R-32 ACs upon AC replacement actions. At present, leading importers are fully aware of existence and technical features of R-32 ACs up to 5 RT, as well as have access to main global suppliers.	
Reasons for delay. If the project was discontinued, please explain the reasons and indicate to what activities the funding was reallocated: NA	
REPLICABILITY AND SUSTAINABILITY	
Associated technical assistance/training provided	NOU provided training on handling of flammable refrigerant to RAC technicians under the Good Practices of Refrigeration Training Programme. Database of Technicians are being prepared to enhance of training on priority basis.
Associated policies or regulatory measures planned/promulgated, if any	Recommended to include a clause to the Government Procurement Guidelines to prioritize purchase of equipment with low GWP alternatives for acquisition of new and replacement of existing equipment. Low-GWP technologies considerations were incorporated with Green Building Guidelines, and higher grading/standard allows allocation of 2 extra marks for buildings that use 0 ODP, Low GWP AC systems
Number of additional end-users that followed the same approach as a result of the project	No external monitoring is at place, however, per interviews collected from importers, it is perceived that customers are open for new technologies (R 32, R 290), being that the argument over energy efficiency is remarkably positive. NOU is continuing follow up the market trends.
Comments on the reasons for success of failure of the project and recommendations: At the beginning of the project, there were no importer of R-32 ACs. Cost of early shipments of R-32 ACs were higher compare to R-410A ACs, and even incentive proposed was not enough to compensate the price difference. However, with the increase of number of importers who imported R-32 ACs the scenario has changed, but still it took several years from the approval of the Stage I to bring AC price competitive nowadays, being that gross of replacements occurred between 2018 and 2019. Propaganda against R-32 as mild flammable refrigerant was a barrier for market penetration, and is still a great barrier for introduction of R-290a units (allied to lack of suppliers willing to export these A3 units). However, the project was critical to support the market penetration of the R-32 technology. Incentive payment was the “game changer” for the beneficiaries and helped to bridge the gap of the difference of cost of new technology equipment. The Government consider that would be highly recommended to continue similar incentives under the HPMP stage II to minimize the burden when acquiring new alternative technologies. Monitoring funding (for both EE gains and replicability results) should also be allocated.	

PROJECT DESCRIPTION	
Country	Togo
Stage of the HPMP	Stage I
Implementing agency	UNEP/UNIDO
Project title	- Project title: HCFC phase-out management plan - Activity title: Replacement scheme aiming to facilitate the replacement of HCFC-based air-conditioners to low-GWP alternative
Subsector/application	- Project subsector/application: servicing sector - Activity subsector/application: replacement of 70 HCFC-22-based air-conditioners (12,000 BTU and 18,000 BTU cooling capacity) by R-290-based air-conditioners (18,000 BTU cooling capacity)
Alternative technology	Natural refrigerant (propane, R-290)
Number of beneficiaries planned	3 facilities
HCFC-22 to be phased out (mt)	0.2145 (ODS 3.9)
Funds approved (US \$)	USD 90,000
Co-funding commitment (US \$)	The beneficiaries will have to provide inland transportation for the equipment and install the R-290-based air-conditioners.
Planned date of completion	December 2021
Description:	
<p>Facilities were identified to benefit from the financial incentive scheme aiming to facilitate the replacement of HCFC-based air-conditioners with low-GWP alternatives. The beneficiaries will have to provide inland transportation for the equipment and install them. UNIDO will provide technical support during the installation process. A supplier in a position to deliver the required air-conditioners was identified and commercial contract was established. The procurement process is ongoing and is expected to be completed during the course of 2019.</p> <p>The planned payment of incentives to commercial facilities to convert refrigeration systems from HCFC-22 to low-GWP alternatives was replaced by a replacement scheme expanded to more buildings due to inadequate funding for the refrigeration conversion after closer survey of proposed beneficiaries.</p>	
ACHIEVEMENTS AND IMPACT	
Number of beneficiaries assisted	Project is ongoing
HCFC-22 phased out (mt)	Project is ongoing
Co-funding provided (US \$)	N/A
Actual date of completion	Project is ongoing
Main results obtained and any other environmental/economic impact achieved: Project is ongoing	
Reasons for delay. If the project was discontinued, please explain the reasons and indicate to what activities the funding was reallocated: Project is ongoing	
REPLICABILITY AND SUSTAINABILITY	
Associated technical assistance/training provided	Project is ongoing
Associated policies or regulatory measures planned/promulgated, if any	Development of guidelines, taking into account international experience, for installation and servicing of R-290-based equipment- still ongoing.
Number of additional end-users that followed the same approach as a result of the project	Project is ongoing
Comments on the reasons for success of failure of the project and recommendations: Project is ongoing	

Group II Projects to demonstrate alternative technologies

PROJECT DESCRIPTION	
Country	Chile
Stage of the HPMP	HPMP (2011-2025)
Implementing agency	UNDP
Project title	HCFC phase-out management plan Stage 1
Subsector/application	RAC/ Commercial /Supermarkets
Alternative technology	Non established.
Number of beneficiaries planned	5
HCFC-22 to be phased out (mt)	2.15 mt
Funds approved (US \$)	485,863
Co-funding commitment (US \$)	
Planned date of completion	Completed (December 2018)
Description: The project aimed to provide technical assistance and co-financing to a determined number of supermarkets (including large, medium and small examples) in the selection of the most viable technology, the project design, the installation and servicing. The converted installations would become demonstrative cases to be documented and disseminated in the sector. The demonstrative conversions would help understand the in-situ complexities and barriers of adopting these technologies in order to help remove them to encourage others to replicate.	
ACHIEVEMENTS AND IMPACT	
Number of beneficiaries assisted	2 (3 facilities)
HCFC-22 phased out (mt)	Aprox. 3.30 mt
Co-funding provided (US \$)	USD 482,790 (from CCAC). Beneficiary companies invested more than USD\$ 1 million for the construction of the RAC system for each supermarket.
Actual date of completion	July 2018
Main results obtained and any other environmental/economic impact achieved: Transcritical CO ₂ technology was introduced into the country, becoming the default technology in new supermarkets for two (2) of the major supermarket chains in the country. Transcritical CO ₂ installations were between 15% and 40% more energy-efficient than comparable installation with HCFC-22 and R-507.	
Reasons for delay. If the project was discontinued, please explain the reasons and indicate to what activities the funding was reallocated: The project was delayed as supermarkets did not have experience on the management of the new technology, companies were afraid of be the first to try the technology. Also, it was difficult to match the project's schedule with the supermarket's business plan schedule. Another issue that caused delays in the implementation of the project was the difficulties to design an evaluation method that ensure a fair assessment between different approaches.	
REPLICABILITY AND SUSTAINABILITY	
Associated technical assistance/training provided	Workshops, awareness actions, information sharing and sensitization on alternatives technologies for the supermarket sector, mainly transcritical CO ₂ .
Associated policies or regulatory measures planned/promulgated, if any	N/A.
Number of additional end-users that followed the same approach as a result of the project	After the project was completed, 6 additional stores using transcritical CO ₂ as refrigerant were built.
Comments on the reasons for success or failure of the project and recommendations: The project was successfully implemented, although with some delays, with an approach that covered the technical and financial aspects for the introduction of a new technology. First, the project rose the awareness on the technologies available for phase out the use of HCFC in the supermarket sector, then trained the technical decision-makers of the beneficiary companies on the technology and reduced the risk associated with the adoption of the new technology when covered part of the incremental costs for the adoption of the new technology. Another reason for the success of the project was that the company selected for the design and installation of the new systems had ample experiences in the selected technology in other regions and that the company was closely supported by its technological suppliers. Transcritical CO ₂ - based systems installed in Chile are more energy-efficient than comparable HCFC-22 of HFC-based systems, which helped to the technical teams at the supermarket chains to take the decision to select transcritical CO ₂ as the default technology for new installations.	

PROJECT DESCRIPTION	
Country	Ecuador
Stage of the HPMP	HCFC phase-out management plan (stage I, third tranche)
Implementing agency	UNIDO
Project title	Demonstration Project of R-290 (propane) as an alternative refrigerant in a cold store used for flower storage.
Subsector/application	Cold store used for flower storage to 1°C (±2°C) whose cooling system has six evaporator blocks, which are fed by two externally located condensing unit, with a capacity of 160,000 BTU / hr approximately.
Alternative technology	As part of a demonstration project, it is proposed to convert the refrigeration systems that provide the flow coldstore with cooling to R-290.
Number of beneficiaries planned	For demonstration one beneficiary is selected. The same beneficiary can replicate the results in at least 10 cold rooms used for flower storage or store perishable goods in similar conditions.
HCFC-22 to be phased-out (mt)	0,03 Ton
Funds approved (US \$)	As component of HPMP, no specific funds for the project
Co-funding commitment (US \$)	In-kind and approximately 10,000 USD
Planned date of completion	No completion specified. It is planned for November 2019.
Description:	
<p>On behalf of the Government of Ecuador, UNIDO as the designated implementing agency has submitted as component of the HPMP the demonstration project of R-290 as an alternative refrigerant in a cold store used for flower storage.</p> <p>The project objectives are:</p> <ul style="list-style-type: none"> - to demonstrate the safe use of R-290 as a low-GWP refrigerant in a cold store used for flower storage; - validate the requirements for the operation of cold rooms with R-290 refrigerant; - demonstrate the safe handling and proper risk management for the introduction of flammable refrigerants in the conservation of perishable products, to encourage possible adoption in similar applications. 	
ACHIEVEMENTS AND IMPACT	
Number of beneficiaries assisted	Hilsea Company
HCFC-22 phased out (mt)	Installed capacity 0,03 service ca. 0.01 mt per year
Co-funding provided (US \$)	Not specified
Actual date of completion	Ongoing
Main results obtained and any other environmental/economic impact achieved:	
<ul style="list-style-type: none"> - Successful implementation of this project would be an advance in technology and would enable the introduction of a low-GWP alternative to a sector that otherwise can migrate to HFC-404A or HFC-507A. - Application of methods to risk assessment and eliminate sources of ignition in refrigeration systems with flammable refrigerants. - Technical training and qualification of the personnel responsible for providing the refrigeration maintenance and installation with HC as refrigerant. - This project will generate inputs for updating/formulating the regulations and standards for flammable refrigerants that Ecuador intends to adopt during the implementation of the HPMP Stage II. - Dissemination workshops are planned at the end of the project, focused on end users related to this sector or with similar cooling needs. - Application of methodology based on social, economic and environmental life cycle analysis to determine the best replacement option for refrigeration technologies that deplete the ozone layer and cause global warming. 	
Reasons for delay. If the project was discontinued, please explain the reasons and indicate to what activities the funding was reallocated: N/A	
REPLICABILITY AND SUSTAINABILITY	
Associated technical assistance/training provided	<p>A workshop will be carried out to provide support for the beneficiary company and the company responsible for the installation of the HC refrigeration equipment. The training included both theory and practice workshops with an international expert that focused on the safe handling of R-290 refrigerant during the installation and maintenance services of refrigeration systems. The main topics presented were:</p> <ul style="list-style-type: none"> - HCFC -22 system charged with R-290; - Risk assessment and eliminate sources of ignition in refrigeration systems with flammable refrigerants; - Modifications to electrical components and enclosures/panels; - Methods of leak detection system.

PROJECT DESCRIPTION	
Country	Ecuador
Associated policies or regulatory measures planned/promulgated, if any	As component of the HPMP, the Government of Ecuador is promoting the use of hydrocarbon. For the training activities, the demonstration and use of hydrocarbon as alternative is compulsory. Furthermore, Stage II of Ecuador's HPMP and Kigali Amendment include activities for development and establishment of regulations and standards for flammable refrigerants that will allow the safe handling in the use and servicing of HC in refrigeration equipment. The project's outputs will be taken as input for the regulations or standards that will be formulated.
Number of additional end-users that followed the same approach as a result of the project	The flower export association has provided support on this project and the results will be disseminated through them. It is expected that other producers will also follow the approach. In addition, the information generated on the use and measures to ensure the safe handling of HC in refrigeration systems would be made available, which could benefit other projects in the region.
Comments on the reasons for success of failure of the project and recommendations: The project is being implemented with local service and engineering companies and training is provided to the service companies. All the components and equipment has been purchased through local suppliers. It is possible to replicate results like this.	

PROJECT DESCRIPTION	
Country	Georgia
Stage of the HPMP	I
Implementing agency	UNDP
Project title	Demonstration projects to use natural refrigerants
Subsector/application	Servicing
Alternative technology	CO2 as a target for demonstration
Number of beneficiaries planned	1
HCFC-22 to be phased out (mt)	TBD – after a market search for potential partners is completed
Funds approved (US \$)	91,300
Co-funding commitment (US \$)	TBD – after a market search for potential partners is completed
Planned date of completion	December 2020
Description: HPMP-I had long planned for demonstration of a new technology running on CO2 or ammonia with procurement of a complete package for smaller scale application depending on market prices.	
ACHIEVEMENTS AND IMPACT	
Number of beneficiaries assisted	0
HCFC-22 phased out (mt)	TBD – after a market search for potential partners is completed
Co-funding provided (US \$)	TBD – after a market search for potential partners is completed
Actual date of completion	TBD – planned December 2020
Main results obtained and any other environmental/economic impact achieved: Georgia has not started any implementation except identification of potential project sites since the funding in the previous tranche was not enough to have a type of demonstration they wanted to have. Currently the data collection process is ongoing which will help see which type of demos could be financed by the project, and on what conditions (like co-finance, type of technology).	
Reasons for delay. If the project was discontinued, please explain the reasons and indicate to what activities the funding was reallocated: N/A. NOU-Georgia planned to combine remaining funds from Tranche 2 and new funding from Tranche 3 to attempt to capitalize on this opportunity and make the project more successful due to generally high prices of new technologies related to CO2 or ammonia as compared to HFC systems available on the market.	
REPLICABILITY AND SUSTAINABILITY	
Associated technical assistance/training provided	Training will be provided by supplier of equipment, if the demonstration project is successful.
Associated policies or regulatory measures planned/promulgated, if any	To be reported later
Number of additional end-users that followed the same approach as a result of the project	Only one project could be possible with available funding. Replication results will mostly depend on capital and operating costs related to the new equipment.
Comments on the reasons for success of failure of the project and recommendations: To be reported later in 2020.	

PROJECT DESCRIPTION	
Country	Grenada
Stage of the HPMP	Stage I
Implementing agency	UNEP
Project title	Demonstration project for the replacement of existing HCFC-based equipment
Subsector/application	Split AC systems
Alternative technology	Hydrocarbons
Number of beneficiaries planned	Not specified
HCFC-22 to be phased out (mt)	Not specified
Funds approved (US \$)	9,000
Co-funding commitment (US \$)	No additional funding was provided
Planned date of completion	December 2020
Description: A small-scale demonstration project for the replacement of existing HCFC-based equipment was approved at ExCom-77, as part of UNIDO's component of Grenada's HPMP Stage I.	
ACHIEVEMENTS AND IMPACT	
Number of beneficiaries assisted	2 AC units replaced at a community college

PROJECT DESCRIPTION	
Country	Grenada
HCFC-22 phased out (mt)	Not available
Co-funding provided (US \$)	No co-funding provided
Actual date of completion	December 2018
<p>Main results obtained and any other environmental/economic impact achieved: The National Ozone Unit (NOU) in the Energy Division of the Ministry of Infrastructure Development, Public Utilities, Energy, Transport & Implementation, in conjunction with the United Nations Industrial Development Organisation (UNIDO) procured two (2) split AC units using natural refrigerants, R-290 (Propane), that were installed in selected buildings to monitor and compare their performance and energy efficiency.</p> <p>The electrical consumption data of the AC units were collected using an efergy e2 classic energy monitor. The consumption was logged on an hourly basis in kilowatt hours (KWh). From this data other parameters such as energy cost and carbon emissions can be calculated. The electricity consumption of the AC units was logged for a minimum of one month (excluding weekends and holidays). Electricity consumption comparisons were made between the units that were previously installed (R-410A) and the replacement R-290 units.</p> <p>In one case, the previously installed 18,000 BTU (5.2KW) split AC unit using R-410A was replaced with the R-290 unit. The exercise showed that the R-290 unit performed approximately 30.03% more energy efficient than the previously installed unit, which resulted in savings in running costs and reduction in GHG emissions.</p>	
<p>Reasons for delay. If the project was discontinued, please explain the reasons and indicate to what activities the funding was reallocated:</p>	
REPLICABILITY AND SUSTAINABILITY	
Associated technical assistance/training provided	<p>Over 60% RAC technicians in Grenada have received some level of training in hydrocarbon refrigerant technology. This training is geared for RAC technicians with at least three years' experience in the field. The focus of the training is on the safe handling of flammable refrigerants. Day one of the training covers the theoretical aspects and day two is used for practical sessions. Some of the major topics covered in the training included:</p> <ul style="list-style-type: none"> • Properties of hydrocarbons • Risk assessment • Legislation, policy and standards • Fire and electrical safety • Charge limitation and room size calculations • Personal protective equipment and specialize tools and equipment required for installation and servicing • Leak detection • Installation, servicing and maintenance practices • Brazing and pipe connections
Associated policies or regulatory measures planned/promulgated, if any	<p>Through a series of consultations and workshops, with the last one being a National Refrigerant Symposium for stakeholders in the RAC industry in Grenada (organized on June 28th, 2019 in observance of the World Refrigeration Day), the NOU Grenada managed to raise awareness of stakeholders' on the importance of the natural refrigerants. Among the stakeholders present at the symposium were: RAC equipment and refrigerant importers, procurement officers, government officials, RAC technicians, the Grenada Bureau of Standards, academia and training institutions and end users.</p> <p>Until recently hydrocarbon-based AC systems were not available in Grenada. At the symposium, participants were informed that there are two Grenadian based companies that have Hydrocarbon (R290) mini-split AC units commercially available and that there are three companies already supplying the hydrocarbon refrigerants. An announcement was made on the testing of R-32 equipment by another company and to make them commercially available on the local market by the third quarter of 2019. A rebate of XCD 100.00 will be offered for every ton of cooling capacity of R-22 and R-410A replaced with the new R-32 equipment. The representative from the Grenada Bureau of Standards also informed of the two new standards that were established for the RAC sector and gave an insight on others that are currently being developed.</p>

PROJECT DESCRIPTION	
Country	Grenada
Number of additional end-users that followed the same approach as a result of the project	Not available at this time.
<p>Comments on the reasons for success of failure of the project and recommendations: This study was carried out using business-as-usual (BAU) scenarios therefore the information presented is specific to the environment where units were installed and monitored. Therefore, individual results and efficiencies may vary at other locations.</p> <p>R-290 split ACs are a sustainable option for Grenada with their ozone and climate friendly refrigerant properties. In addition, they show tremendous potential for energy and cost savings when compared to the previously installed units using fluorinated hydrocarbons.</p>	

PROJECT DESCRIPTION	
Country	Iran (Islamic Republic of)
Stage of the HPMP	I
Implementing agency	Germany
Project title	Financial incentives for technology demonstration
Subsector/application	Refrigeration sector – Introducing Sealed system to beneficiaries, replace the flare connection to brazed one and introduce the brazed component to the market and technicians for using leak tight system, Do demonstration on 3 supermarket systems and hold workshop to promote this technology
Alternative technology	Introduce sealed system for R290
Number of beneficiaries planned	2
HCFC-22 to be phased out (mt)	111 mt (6,1 ODP Tons)
Funds approved (US \$)	415,000 USD
Co-funding commitment (US \$)	-
Planned date of completion	31.12.2015
Description: Nowadays more and more brands are entering the chain supermarket market but during the time when the project took place Refah and Shahrvand were the biggest supermarket chains in Iran (Islamic Republic of). Around 150 branches of Refah and 50 branches of Shahrvand exist. As a consequence of this (market) situation it was decided to start the demonstration project with them and introduce the sealed system as the fundamental point for promoting R290 and HC systems in general. Brazed components were introduced to the market. In cooperation with local technicians and under supervision of an international technical advisor 3 systems were converted to leak tight systems and at the end a workshop was hold for all technicians of these two supermarkets in order to present this new technology and demonstration project itself to them. The technical handbook “Guidelines for Leakage Reduction and HCFC Emission Reduction in Supermarket Refrigeration Systems” was developed, translated to Farsi, printed and distributed to the beneficiaries.	
ACHIEVEMENTS AND IMPACT	
Number of beneficiaries assisted	2 beneficiaries (Refah and Shahrvand) but in total 3 supermarket systems have been converted (2 of Refah and 1 for Shahrvand).
HCFC-22 phased out (mt)	111 mt (6,1 ODP Tons)
Co-funding provided (US \$)	-
Actual date of completion	2014
Main results obtained and any other environmental/economic impact achieved: Introducing leak tight system to the beneficiaries in order to decrease the release of R22 into the atmosphere and also practice with brazed joint and components as the fundamental aspects in using R290 systems.	
Reasons for delay. If the project was discontinued, please explain the reasons and indicate to what activities the funding was reallocated:	
REPLICABILITY AND SUSTAINABILITY	
Associated technical assistance/training provided	Two days workshop was hold for all technicians of these two supermarket and the new technology and demonstration project introduce to them. The technical handbook “Guidelines for Leakage Reduction and HCFC Emission Reduction in Supermarket Refrigeration Systems” was developed, translated to Farsi, printed and distributed to the beneficiaries.
Associated policies or regulatory measures planned/promulgated, if any	Banned on import of RAC equipment that consist of R22
Number of additional end-users that followed the same approach as a result of the project	Nowadays more and more brands are entering the chain supermarket market but during the time when the project took place Refah and Shahrvand were the biggest supermarket chains in Iran (Islamic Republic of). Around 150 branches for Refah and 50 branches for Shahrvand exist.
Comments on the reasons for success of failure of the project and recommendations: Availability of the brazed equipment on market was a challenge and is crucial so that the technicians are able to use this equipment.	

PROJECT DESCRIPTION	
Country	Mauritius
Stage of the HPMP	HCFC Complete phase out
Implementing agency	GIZ
Project title	HCFC Phase-out Management Plan
Subsector/application	AC
Alternative technology	R-290
Number of beneficiaries planned	Still planned
HCFC-22 to be phased out (mt)	(as per the approved proposal)
Funds approved (US \$)	250,000
Co-funding commitment (US \$)	(funds committed by beneficiaries, government or other sources, including the level and source of the fund)
Planned date of completion	(as per the approved proposal) 2030
<p>Description: (description of the main objective of the project, whether it is related to conversions, replacements of systems or any other assistance to the end-user; and the modality of the incentive, i.e., what is paid by the Fund and what is paid by the beneficiary)</p> <p>The HPMP for Mauritius was approved already at the 63rd Excom. The project had originally wanted to implement an end user incentive scheme for converting HCFC equipment to low GWP technology but following the Decision 72/17, this activity was revised in the 3rd tranche submission in 2017. Currently the plan is to use these funds to fund the supermarket conversion as well as support the creation of a supply chain for R290 ACs through an incentive scheme. The project implementation is still being planned as the NOU is in consultations with the various stakeholders on it.</p>	
ACHIEVEMENTS AND IMPACT	
Number of beneficiaries assisted	still ongoing
HCFC-22 phased out (mt)	(annual amount of HCFC-22 used to serve the converted/replaced systems)
Co-funding provided (US \$)	(indicate the value and the source of the co-funding)
Actual date of completion	(if completed)
<p>Main results obtained and any other environmental/economic impact achieved: (description of the main results achieved by the implementation of the project against the original plan; if none, explanation of the reasons)</p> <p>NA</p>	
<p>Reasons for delay. If the project was discontinued, please explain the reasons and indicate to what activities the funding was reallocated: NA</p>	
REPLICABILITY AND SUSTAINABILITY-	
Associated technical assistance/training provided	Under the HPMP all efforts are already ongoing to ensure that the trainers and technicians are trained in both CO2 for the supermarkets and HC for ACs
Associated policies or regulatory measures planned/promulgated, if any	Mauritius is committed to achieve early phase out of HCFC while discouraging use of high GWP refrigerants and therefore CO2 is clearly the option that is best suitable for the supermarket sector.
Number of additional end-users that followed the same approach as a result of the project	
<p>Comments on the reasons for success of failure of the project and recommendations: (lessons learned on the parameters that should be in place for the project to be successful and any other lesson learned that could be applicable to future similar projects) Ongoing.</p>	

PROJECT DESCRIPTION	
Country	Mauritius
Stage of the HPMP	HCFC Complete phase out
Implementing agency	GIZ
Project title	HCFC Phase -out Management Plan
Subsector/application	Demonstration project - Supermarket
Alternative technology	CO ₂
Number of beneficiaries planned	1
HCFC-22 to be phased out (mt)	(as per the approved proposal)
Funds approved (US \$)	200,000
Co-funding commitment (US \$)	(funds committed by beneficiaries, government or other sources, including the level and source of the fund)
Planned date of completion	(as per the approved proposal) 2028
Description:	
<p>The HPMP for Mauritius was approved already at the 63rd ExCom. The project had originally wanted to do a demo for a working supermarket. However, at the time of implementation the NOU through discussions with the supermarkets reached a conclusion that there was a general know-how deficient on CO₂ technologies. So instead, a demonstration unit for CO₂ use in the supermarket sector was designed specifically for the UDM (the local university). 2 trainings systems have been provided one working solely on CO₂, another a cascade system using Ammonia and CO₂. This has been done for training purposes for students and working technicians. There is ongoing consultations with supermarket owners to determine if a local supermarket can be converted to use CO₂.</p>	
ACHIEVEMENTS AND IMPACT	
Number of beneficiaries assisted	still ongoing
HCFC-22 phased out (mt)	(annual amount of HCFC-22 used to serve the converted/replaced systems)
Co-funding provided (US \$)	(indicate the value and the source of the co-funding)
Actual date of completion	(if completed)
Main results obtained and any other environmental/economic impact achieved: (description of the main results achieved by the implementation of the project against the original plan; if none, explanation of the reasons)	
<p>Mauritius has become one of the few countries in the world that has a state of the art CO₂ system at a local training institute. This unit has allowed graduating technicians to gain hands-on training on how to work with CO₂. This we believe will help the local supermarket sector move towards this technology which is now globally becoming the Business as Usual technology option for this sector.</p>	
Reasons for delay. If the project was discontinued, please explain the reasons and indicate to what activities the funding was reallocated:	
NA	
REPLICABILITY AND SUSTAINABILITY	
Associated technical assistance/training provided	Training was provided during the time of commissioning of the system to the trainers at UDM and other local institutions as well as to industry technicians interested in working with CO ₂ . This has also become part of the regular RAC courses conducted at the UDM.
Associated policies or regulatory measures planned/promulgated, if any	Mauritius is committed to achieve early phase out of HCFC while discouraging use of high GWP refrigerants and therefore CO ₂ is clearly the option that is best suitable for the supermarket sector.
Number of additional end-users that followed the same approach as a result of the project	This is ongoing and before the end of the HPMP it is hoped that supermarkets will be adopting this technology. NOU has been in consultations with the supermarkets on this.
Comments on the reasons for success of failure of the project and recommendations: (lessons learned on the parameters that should be in place for the project to be successful and any other lesson learned that could be applicable to future similar projects)	
Ongoing.	

PROJECT DESCRIPTION	
Country	Saint Vincent and the Grenadines
Stage of the HPMP	Stage 1
Implementing agency	UNEP/UNIDO
Project title	Demonstration project for retrofitting to HC refrigerants
Subsector/application	Commercial AC
Alternative technology	Hydrocarbon refrigerant
Number of beneficiaries planned	2
HCFC-22 to be phased out (mt)	Not specified
Funds approved (US \$)	US \$ 99,800
Co-funding commitment (US \$)	No co-funding was provided
Planned date of completion	December 2026
Description: Demonstration project for retrofitting to HC refrigerants in a government and a private building, and provision of conversion kits, was approved for Saint Vincent and the Grenadines, as part of UNEP component of their HPMP. The aim of the pilot project was to provide a physical demonstration for what could be achieved, in terms of energy savings, through retrofitting to low-GWP refrigerants. With the expected positive results from the demonstration, the equipment owners and other stakeholders would recognize the advantages and benefits of retrofitting and reduce the use of HCFCs.	
ACHIEVEMENTS AND IMPACT	
Number of beneficiaries assisted	Two – a clinic and the National Archives
HCFC-22 phased out (mt)	Not available
Co-funding provided (US \$)	No co-funding was provided
Actual date of completion	Ongoing project
Main results obtained and any other environmental/economic impact achieved: The NOU, in cooperation with UNEP, has selected two buildings to be included in the pilot program. One is a clinic where most of the AC units are not working and in dire need. The other is the National Archives that also houses the Government’s servers. The technology of choice is HC based AC units, following intense training of RAC certified technicians. So far, preliminary needs assessment was done, and the equipment was purchased. Training and retaining was done as recently as July 2019. The installations are expected to commence soon.	
Reasons for delay. If the project was discontinued, please explain the reasons and indicate to what activities the funding was reallocated: N/A	
REPLICABILITY AND SUSTAINABILITY	
Associated technical assistance/training provided	So far, 104 technicians successfully completed their training in “Good Refrigeration Practices, Recovery, Recycling and Retrofitting of HCFCs, Alternative Technology and Natural Refrigerant with Particular Emphasis on HC Technology, with 16 specially trained under the retrofitting exercise” Description of the specific subjects of the training provided to support the project and the coverage in terms of technicians/end-users trained is as follows: Ozone layer depletion and the Montreal protocol; Refrigerant Issue; Introduction to Hydrocarbon; Refrigerant Safety; Guidelines for working with HCs; practical applications of refrigerants; Component service procedure; Conducting Conversions; Installation and servicing procedure; Case studies using Hydrocarbon for conversion; Practical work
Associated policies or regulatory measures planned/promulgated, if any	Not applicable at this point, the project is still ongoing.
Number of additional end-users that followed the same approach as a result of the project	Not applicable at this point, the project is still ongoing.
Comments on the reasons for success of failure of the project and recommendations: Project is ongoing.	

PROJECT DESCRIPTION	
Country	Venezuela (Bolivarian Republic of)
Stage of the HPMP	Stage II, Manufacturing Sector
Implementing agency	UNIDO
Project title	Phase out HCFC in the manufacturing sector
Subsector/application	Service sector. Chiller used in hospital
Alternative technology	R-290 Cold water chiller
Number of beneficiaries planned	N/A
HCFC-22 to be phased out (mt)	0.005 mt
Funds approved (US \$)	Integrated in HPMP
Co-funding commitment (US \$)	In kind
Planned date of completion	Planned for end 2019
<p>Description: The project aims to introduce non-ODS low GWP alternatives to the manufacturing sector in the country. The selected alternative for the project was R-290 locally bottled which is widely available, fulfils the standards, reduces energy consumption and is a reliable technology.</p> <p>The objective of the conversion was to phase out of 5 (five) kilos of HCFC-R22 and ca. 3 (three) kilos consumed for service per year. The HCFC-22 based unit was dismantled and replaced with a R-290 unit with equivalent capacity (5 TR – 60000 Btu) compact air conditioning.</p>	
ACHIEVEMENTS AND IMPACT	
Number of beneficiaries assisted	One beneficiary, a second one has been selected.
HCFC-22 phased out (mt)	0.005 mt and ca. 0.003 mt used for service per year
Co-funding provided (US \$)	N/A
Actual date of completion	November 2018
<p>Main results obtained and any other environmental/economic impact achieved:</p> <p>The objectives of the project were achieved. The R-290 based unit is installed and working with energy consumption reduction of ca. 20% compared to the previous unit. The old HCFC-R22 was dismantled and destroyed, average refrigerant service consumption was more than 50% of total in the unit.</p> <p>The new unit, designed and assembled locally by national companies and experts, was installed by a local refrigeration service company. The project was promoted and presented to other producers through the refrigeration chamber in the country.</p> <p>The possibility of using A3 classified refrigerants, safely and without altering the performance of the equipment was demonstrated. The results will contribute to promoting the use of substances and technologies with low-GWP in unusual applications.</p>	
<p>Reasons for delay. If the project was discontinued, please explain the reasons and indicate to what activities the funding was reallocated: N/A</p>	
REPLICABILITY AND SUSTAINABILITY	
Associated technical assistance/training provided	The project, in addition to the replacement of the equipment, included training in refrigeration good practices for the personnel in charge of servicing the system. It was a good opportunity to train other service providers and technicians in safely handling of low GWP alternatives and promotion of R-290 as alternative.
Associated policies or regulatory measures planned/promulgated, if any	The National Ozone Unit has a plan to promote HC as refrigerant under the HPMP activities. The training in service and promotion of hydrocarbon is priority in the country.
Number of additional end-users that followed the same approach as a result of the project	It is expected to have a second conversion and promote the results through the refrigeration chamber. Other end users which may be interested will receive support from the project.
<p>Comments on the reasons for success of failure of the project and recommendations:</p> <p>Training of personnel related to system maintenance is very important to ensure the proper functioning of the system. Periodic monitoring will allow the early detection of equipment malfunctions, avoiding damages.</p> <p>The strengthening of human resources and technology will allow replicating this experience in a simple and fast way.</p>	

Group III: Leakage reduction programmes at end-users

PROJECT DESCRIPTION	
Country	Brazil
Stage of the HPMP	Stage 1
Implementing agency	Germany
Project title	HCFC-22 Better Containment Demonstration Projects in Brazilian Supermarkets
Subsector/application	Commercial Refrigeration / Compound Systems in Supermarkets
Alternative technology	Introduction of sealed system design and best maintenance practices for HCFC-22 containment
Number of beneficiaries planned	5
HCFC-22 to be phased out (mt)	909 (reduction target for the whole servicing sector to be achieved by training and capacity building activities, technical assistance and outreach campaigns)
Funds approved (US \$)	860.736,00
Co-funding commitment (US \$)	-
Planned date of completion	31.12.2015
Description: The project focuses on improved containment practices for existing HCFC systems by demonstrating how to improve system tightness by replacing old inefficient parts and using better seals, valves, pipe connections etc. The case studies differ from one another in terms of refrigerant charge, type of system and critical components. This practice, which leads to energy savings and lower demand for HCFCs is efficient, innovative and costs are comparatively low, enhancing the replication of the methodology by other supermarkets. Costs for equipment and tools, engineering and training were covered by the Fund. The selected partner supermarkets paid for technicians' service, consumables and servicing tools.	
ACHIEVEMENTS AND IMPACT	
Number of beneficiaries assisted	3
HCFC-22 phased out (mt)	0,774 mt
Co-funding provided (US \$)	-
Actual date of completion	to be completed until 31.12.2019
Main results obtained and any other environmental/economic impact achieved:	
<p>Summary of the main findings from the first two interventions:</p> <ul style="list-style-type: none"> - Annual leakage rate before the project: <ul style="list-style-type: none"> • Supermarket 1: 62% of the system charge size (no leak alarms were reported since the intervention in 04/2018): The containment of 118 kg of HCFC-22 corresponds to a reduction of direct emissions of 213.580 kg of CO₂ equivalent. • Supermarket 2: 130% of the system charge size (no leak alarms were reported since the intervention in 09/2018): The containment of 156 kg of HCFC-22 corresponds to a reduction of direct emissions of 282.360 kg of CO₂ equivalent. - Improvements in system performance, e.g. superheat reduction, reduction of discharge temperature to recommended values; reduction of condensation temperature; increase of evaporation temperature and thus increasing the performance of the system. - Average COP increase: <ul style="list-style-type: none"> • Supermarket 1: Average COP increase of 13% was achieved in the case of the plus cooling system and 4% in the case of the minus cooling system. • Supermarket 2: Average COP increase of 7,4% was achieved in the case of the plus cooling system. - Increase in energy efficiency and therefore the reduction of energy consumption contributes to the reduction of indirect emissions as well. - Improvement of HCFC-22 containment practices adopted by the maintenance team of the supermarkets was clearly noted. 	
Reasons for delay. If the project was discontinued, please explain the reasons and indicate to what activities the funding was reallocated:	
<p>The technical condition of the supermarket systems was more critical than expected and interventions in order to correct the identified problems were much more complex. Some examples:</p> <ul style="list-style-type: none"> - Refrigerant leakages are the focus of the project. Annual refrigerant consumptions of the selected supermarket RAC systems were up to 200% of the initial refrigerant charge. Most of the selected systems comprise of hundreds of mechanical circuit components connections and provide constant sources of refrigerant leakage. Wrong dimensioning, selection and installation practices of refrigerant circuit components lead to abrupt losses of high amounts of refrigerants. Executed insulation of circuit tubing and components (filter elements, suction header, liquid accumulators, etc.) is generally inadequate and lead to corrosion. In many cases pressure vessels are undersized in terms of the maximum allowable working pressure PS (for HCFC-22 refrigerant), safety valves are not dimensioned as required. Operating conditions of primary controllers are not balanced. Most compound plant systems do not operate energy efficient and minimum storage temperatures for frozen and chilled goods are not maintained. Strategic structure for scheduled and preventive maintenance is generally not integrated. 	

PROJECT DESCRIPTION	
Country	Brazil
	<ul style="list-style-type: none"> - Therefore, larger investments for equipment and for national and international technical consultancy were required even though it was not initially expected. - In addition, there had been delays in the delivery of purchased equipment and components, which had required special attention from the project team. In the meantime, changes to the original layout of the refrigeration system also occurred, which required a reassessment of the project as well as additional technical site visits and data collection. - Two supermarkets announced, close to the beginning of the implementation of the intervention plan, that they would like to decline from the project due to changing of corporate governance strategy, which intends to change the whole refrigeration system within the next two years to an indirect/direct CO₂/ R134-a subcritical cascade system. One supermarket could immediately be replaced by another with the same technical needs and the already purchased equipment could be used as intended. - In order to identify a suitable replacement for the second store, additional technical visits were made. However, given that all equipment purchased was designed and specified in accordance with the originally selected store and its refrigeration system, the project could not be implemented without additional investments in the vast majority of stores. Negotiations with some suitable supermarkets were not successful. - In order to make the best possible use of the equipment and materials, which were already purchased for the implementation of the last demonstration project, vocational training institutions were identified, among the ones that are already partners in the implementation of the HPMP best practice training program to receive the equipment as donation. The functional and sustainable use of the equipment was ensured through a careful selection process, which considers qualification criteria, such as: sustainability, proposed design and work plan, regional importance, synergies with activities already underway within the HPMP. - As HPMP Stage 2 has given priority to HCFC-22 containment in the AC sector, some of the partner schools are not offering training courses in the commercial refrigeration. Therefore, the donation of the equipment will improve the technical infrastructure for demonstration of sealed system design for commercial refrigeration. Besides that, it will increase the capacity of the training institutions for commercial refrigeration in the framework of the HPMP.
REPLICABILITY AND SUSTAINABILITY	
Associated technical assistance/training provided	Training of supermarket technical staff in best practices in commercial refrigeration, additional 4.800 refrigeration technicians trained in best practices (e.g. sealed system design, leak detection, brazing, recovery and recycling, data recording, planned preventive maintenance)
Associated policies or regulatory measures planned/promulgated, if any	The intention of the project was not to regulate the sector but to demonstrate best practices.
Number of additional end-users that followed the same approach as a result of the project	The project demonstrates to the supermarket sector in Brazil the possible best practices to improve the operation of their refrigeration systems with HCFC-22 or HFCs (e.g. 404A) with economic and environmental gains. The results are being widely disseminated and with the cooperation of the Brazilian Supermarket Association – Abras a great number of end -users will get to know the demonstrated methodology. Besides that, the refrigeration technicians involved in the implementation of the intervention plans also work for other supermarket chains and since they were enthusiastic with the results obtained for the supermarket they intend to apply the methodology to others supermarket chains with high leakage rates in the refrigeration system.
Comments on the reasons for success or failure of the project and recommendations:	
Lessons learnt are described below:	
<ul style="list-style-type: none"> - Components and equipment for the implementation of the intervention plans in the framework of better HCFC containment demonstration projects such as the fixed leak detection and monitoring system are not always available in the national market. Selecting alternative components and contacting potential national suppliers was harder than expected. Moreover, finding suppliers interested in participating in tenders and offering supplies in accordance with the project's technical specifications and requirements has proven to be a difficult task. The tender had to be published several times and the contract for the supply of all items listed in the tender notice took almost one year to be completed. In addition, most of the contracted suppliers had not been able to meet the agreed delivery schedules. - It took more than three years since the first visit to the selected supermarkets and the real start of the implementation due to the delay in the equipment procurement and the delivery. Therefore, several changes had occurred in the management structure and technical team of the supermarkets which led to the withdrawal of two initially selected supermarkets. 	