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执行蒙特利尔议定书
多边基金执行委员会
第八十四次会议
2019 年 12 月 16 日至 20 日，蒙特利尔

关于在核准的氟氯烃淘汰管理计划下供资的最终用户奖励计划的报告(第 82/54 号决定)

背景

1. 在第八十次和八十一次会议上，执行委员会对氟氯烃淘汰管理计划若干次付款申请中所列的促进制冷和空调系统转用氟氯烃替代品的最终用户奖励计划提出关切。关切的问题包括政府/最终用户没有为支持采用选定的低全球升温潜能值替代技术作出坚定承诺，缺乏支付转型费用所需的共同融资，没有进行与转型相关的培训，随之而缺乏可持续性。因此，委员会在核准付款申请时，提出一项谅解，即除其他外，对维修技术人员进行培训将增强最终用户奖励方案的可持续性，最终用户将为参与该计划共同出资。

2. 在第八十二次会议上，应一名成员的请求，执行委员会从提交供一揽子核准的项目清单中删除了在最终用户奖励计划方面遇到困难的氟氯烃淘汰管理计划的付款申请。在对此事进行讨论后，委员会请秘书处：

- (a) 汇编关于在核准的氟氯烃淘汰管理计划下供资的最终用户奖励计划(也称为示范、试点项目和奖励方案)的信息；和
- (b) 提交一份报告，内容包括：
 - (一) 关于已核准活动的信息，例如待淘汰吨数、将提供的资金、共同出资、受益者人数、行业和相关技术援助；
 - (二) 计划现况，包括延误情况信息，如果相关的话；
 - (三) 执行委员会关于涉及氟氯烃淘汰管理计划下核准的最终用户奖励计划的最终用户转型决定(第 82/54 号决定)。

本文件范围

3. 根据第 82/54 号决定，秘书处编写了本文件，内含三个部分和一项建议：
 - (a) 执行委员会关于最终用户转型的决定；
 - (b) 关于核准的最终用户相关活动的信息，包括待淘汰吨数、提供的资金、共同出资、受益者人数、行业、相关技术援助以及计划现况，包括延误情况信息；
 - (c) 秘书处的意见；和
 - (d) 建议。
4. 文件还包含以下两个附件：
 - 附件一 按国家分列的双边和执行机构提供的投入
 - 附件二 多边基金与最终用户活动有关的政策摘要

数据收集所用方法

5. 为编写本文件，秘书处对迄今已核准的第 5 条国家的氟氯烃淘汰管理计划所有第一和第二阶段以及执行委员会已审议的所有付款进展报告和实施计划进行了详细分析。秘书处由此确定了 66 项与最终用户奖励计划有关的活动。
6. 由于没有对最终用户奖励计划信息提出过系统的报告，秘书处编制了一份模板文件，其中包含了第 82/54(b)(一)号决定要求的内容(即，项目目标和项目说明；待淘汰吨数；基金供资和最终用户共同出资；受益者人数、行业和相关技术援助)，并将其分发给双边和执行机构。在机构间协调会议期间，¹讨论了这个问题，双边和执行机构就最终用户项目的实施提供了更多的见解。
7. 随后，双边和执行机构提供了详细资料，见本文件附件一。秘书处赞赏各机构提交的投入，它们构成本文件所作分析的基础。

执行委员会关于最终用户转型的决定

8. 由于所有国家的维修制冷和空调设备都用到《蒙特利尔议定书》下的若干受控物质，自多边基金成立以来，执行委员会对与该行业有关的活动予以适当考虑。
9. 委员会一直对制冷维修行业下与最终用户奖励方案有关的事项感兴趣，最早是在第二十六次会议上，当时委员会请秘书处与各执行机构一起编写一份文件，说明执行委员会可以审议商用制冷设备改型项目的所需条件，以及这些项目增量成本的计算方法(第 26/38 号决定)。

¹ 2019 年 10 月 9 日至 11 日，蒙特利尔。

10. 根据第 26/38 号决定，执行委员会审议了一份文件，事关考虑在商用制冷最终用户行业淘汰消耗臭氧层物质的所需条件，² 根据这份文件，委员会通过了商用制冷行业最终用户转型准则。这些准则确立了在优先考虑最终用户转型活动之前的相关先决条件，包括有关氟氯化碳和基于氟氯化碳的设备的生产和进口管制措施已经到位并得到有效执行；氟氯化碳的剩余消费量主要用于制冷维修行业，委员会已获得所有剩余消费量的综合情况，或者没有其他活动能够使有关国家履行其控制氟氯化碳的义务，或者氟氯化碳价格至少在 9 个月内一直高于替代制冷剂的价格，预计价格将继续上涨(第 26/38 号决定)。

11. 从那时起，为商用制冷设备改型提交了数量有限的供资申请，并逐案进行评估，优先考虑对有关国家经济十分重要的农业、渔业或其他食品链产业中冷藏库的改型。

12. 在第三十一次会议上，执行委员会结束了关于制冷剂管理计划准则草案的讨论工作，该准则草案处理低消费量国家的需求，因为这些国家的全部氟氯化碳消费量都用于维修制冷设备(当然也向非低消费量国家提供了广泛的准则)；根据第 31/48 号决定(关于制冷剂管理计划)，第 5 条国家可以采用奖励方案鼓励改装制冷设备。

13. 在第三十二次会议上，执行委员会审议了与鼓励制冷系统改型的奖励方案有关的三项提案。这些提案将用掉其制冷剂管理计划已核准的国家可动用的大部分或全部资金，而不涵盖国内的所有企业，也不会提供足够的淘汰量，使这些国家能够在不采取其他措施的情况下履行其履约义务。经讨论后，委员会决定，可在制冷剂管理计划内提交关于鼓励制冷设备改型的奖励方案的提案，但有一项谅解，即执行机构应与有关国家和负责执行制冷剂管理计划构成部分的所有其他机构协商；必须向有关国家充分说明所有可能进行的投资和非投资活动，且拟议活动的时间安排应适合该国的具体情况(第 32/28 号决定)。

14. 此后，最终用户奖励方案被纳入国家氟氯化碳淘汰管理计划，在许多情况下，通过采用特别是用于家用和小型商用制冷设备的无需改造设备的化合物或 R-600a，帮助减少了 CFC-12 的使用量。

15. 随着氟氯烃淘汰速度加快，许多第 5 条国家在其氟氯烃淘汰管理计划中纳入了最终用户从基于氟氯烃的设备(主要是家用空调)向低全球升温潜能值制冷剂转换/更换的提案。在第七十二次会议上，秘书处提请执行委员会注意一个第 5 条国家的提案，该国将现有的基于 HCFC-22 设备改型采用基于碳氢化合物的制冷剂的方案制度化，其中对风险进行了评估和管理，并适用了基于碳氢化合物设备的安全设置和操作标准。根据上述提案，委员会决定在提议将基于氟氯烃的设备改型为采用易燃或有毒制冷剂的氟氯烃淘汰管理计划、项目或活动的各次付款中纳入以下规定：“如果一个国家着手将基于氟氯烃的制冷和空调设备改型为采用易燃或有毒制冷剂及相关维修，它这样做的理解应该是，由该国承担所有相关责任和风险”(第 72/17 号决定)。这一规定又得到进一步加强，增加了以下案文：“改型只能按照有关的标准和程序进行”(第 73/34 号决定)。

16. 同样在第七十二次会议上，执行委员会根据秘书处编写的文件，³ 结束了关于尽量减少制冷维修行业氟氯烃淘汰活动对气候的不利影响的讨论。为此，委员会除其他外鼓励第 5 条国家在实施氟氯烃淘汰管理计划时，考虑将制冷维修行业活动的重点放在技术人员

² UNEP/OzL.Pro/ExCom/28/47。

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

培训、良好做法、制冷剂的安全处理、制冷剂封闭、回收、复原和回收后的再利用上，而不是改型(第 72/41(c)(三)号决定)。

17. 在最近关于根据国情加强实施最终用户奖励措施的决定中，执行委员会请双边和执行机构提供最终用户奖励方案的详细实施计划，包括在氟氯烃淘汰管理计划第二阶段提出的由受益方共同出资，以优化氟氯烃淘汰管理计划的效力(第 80/58(h)(一)号和第 82/59(h)(一)号决定)。

关于已核准的最终用户相关活动的信息

18. 根据对双边和执行机构提供的信息的分析，秘书处注意到，66 项最终用户相关活动中，有 38 项最初旨在将氟氯烃设备改型为采用易燃的低全球升温潜能值制冷剂。然而，由于国家一级的若干因素，并考虑到执行委员会通过的决定，特别是第 72/17、72/40 和 73/34 号决定，最初提议的最终用户相关活动或被推迟，或被重新设计，以优先考虑制冷维修行业的其他活动。重新配置了与这些活动相关的大部分资金，主要用于加强培训机构或增加制冷技术人员良好维修做法的培训方案。已在氟氯烃淘汰管理计划第一和第二阶段的相关付款进展报告中报告了最终用户相关活动的重新分配情况。

19. 截至第八十四次会议，已确定的最终用户相关活动的执行情况见表 1。

表 1. 第 5 条国家已核准的氟氯烃淘汰管理计划下的最终用户相关活动摘要

机构	共计		已执行	重定向
开发计划署	19		13	6
环境规划署	10		2	8
工发组织	25		8	17
世界银行	1		–	1
法国	1		1	–
德国	10		4	6
共计	66		28	38

20. 秘书处在正在实施的 28 项最终用户相关活动中，确定了以下三个不同类别：

- (a) 转型或更换基于氟氯烃的设备的最终用户奖励计划；
- (b) 在最终用户进行安装活动时演示替代技术的项目；和
- (c) 为最终用户实施的减少泄漏方案。

转型或更换基于氟氯烃的设备的最终用户奖励计划

21. 目前正在实施 15 个转型或更换基于氟氯烃的设备的最终用户奖励计划项目。虽然各项目之间存在差异，但主要方法包括转型或更换现有的基于氟氯烃的设备，以运行使用氢氟碳化物(主要是 HFC-32)或天然制冷剂(即 R-290 或氨)的设备。这些转型或更换主要在私人最终用户中进行，多数发生在室内空调行业，由受益人共同出资。

22. 多边基金为大多数这类项目支付一部分转型(或更换)费用, 根据国家、受益者和应用的具体情况, 从 25%到 50%不等。在一个案例中, 该项目为更换基于氟氯烃的设备提供了预定奖励数额(即, 1 台 9,000 Btu/h 空调机提供 120 美元的奖励, 1 台 24,000 Btu/h 空调机提供 250 美元的奖励), 余款由受益人支付。表 2 汇总了从各机构提交的关于转型或更换基于氟氯烃的设备的最终用户奖励计划报告中提取的信息。

表 2. 转型或更换基于氟氯烃的设备的最终用户奖励计划

国家*	机构	次级行业/ 应用	替代技术	费用(美元)		转型/ 更换		氟氯烃 淘汰 (公吨)	完成日期
				核准	共同出资	计划	迄今为止		
不丹	开发计划署	室内空调/商用空调	GWP<675	79,000	7,982	65	15	0.03	2018 年 8 月
文莱达鲁萨兰国	开发计划署	室内空调/大功率空调	HFC-32/R-290	33,500	暂缺	35	暂缺	暂缺	2020 年 12 月
柬埔寨	开发计划署	室内空调	HFC-32 R-290	350,000	暂缺	900	69	0.14	2024 年 12 月
克罗地亚	工发组织	商用工业用室内空调	HFCs/R-290/R-717	360,000	870,000	10	32	2.22	2015 年 12 月
古巴	开发计划署	商用室内空调	R-404A	350,000	暂缺	500	715	暂缺	2020 年 12 月
斐济	开发计划署	室内空调/渔业	若干项	48,500	暂缺	33	暂缺	暂缺	2020 年 12 月
加纳**	开发计划署	商用冷藏柜	R-407C	38,000	160,295	13	4	0.46	2017 年 9 月
马达加斯加	工发组织	室内空调/渔业	R-290	120,000	暂缺	6	暂缺	暂缺	2020 年 5 月
马来西亚	开发计划署	室内空调/商用空调	若干项	98,000	110,000	4	83	0.20	2017 年 4 月
马尔代夫	开发计划署	室内空调/渔业	HFC-32/R-438A	220,000	369,443	765	150	1.50	2020 年 11 月
尼泊尔	开发计划署	室内空调/商用工业用室内空调	HFC-32	36,000	111,607	18	24	0.08	2020 年 12 月
斯里兰卡	开发计划署	室内空调	HFC-32	60,866	166,410	204	199	0.52	2020 年 12 月
多哥	工发组织	室内空调	R-290	90,000	暂缺	3	暂缺	暂缺	2021 年 12 月
共计				1,883,866	1,795,737	2,556	1,292	5.15	

(*) 肯尼亚和莫桑比克的最终用户活动最近已获批准; 然而, 尚未获得执行情况信息。

(**) 向维修车间提供工具的方案由于不直接针对最终用户而未将其包括在内, 该方案旨在按照环境部实施的严格安全准则, 促进将空调机从 HCFC-22 转型为 R-290。

23. 这些项目得到以下各项的支持: 技术人员使用替代技术的培训、展示替代技术使用情况的讲习班和针对其他最终用户、技术人员及设备 and 制冷剂供应商和进口商的提高认识活动。一些项目得到了法规的支持, 例如今后禁止进口新的基于氟氯烃的空调机, 或消防

部门批准在制冷和空调应用中使用可燃制冷剂。在一个位于欧洲联盟(欧盟)境内的国家的案例中，当地通过欧盟法规提前淘汰氟氯烃，加上氟氯烃价格上涨，确保了其他氟氯烃最终用户采用了类似的系统转型或更换方法。

24. 大多数最终用户项目仍在进行中，双边和执行机构报告的其他惠益还包括：新系统减少能源使用，有机会向国家利益攸关方展示新技术，以及向有关国家进口替代技术。例如，有一个国家的所有最终用户都在项目后转换或更换了其基于氟氯烃的系统，原因是：有法律义务规定比原计划提前淘汰氟氯烃、氟氯烃价格大幅上涨以及可获得支持改型和转换的环境基金。所有其他国家的信息有限，无法了解其他最终用户在多大程度上也因为这些项目而用自己的资金转型或更换其基于氟氯烃的系统。

25. 在这些项目的实施中发现了一些挑战，包括：

- (a) 某些低全球升温潜能值替代技术缺乏可用性，难以在当地市场发现技术提供者。在某些情况下，由于技术提供者数量有限，通过“竞争性选择过程”实施奖励计划并不可行；
- (b) 最终用户缺乏兴趣，原因是所获奖励不足以支付低全球升温潜能值替代技术产生的额外前期费用，或使用替代技术的制冷和空调设备的运行和维护费用更高(例如，在一个案例中，HFC-32 空调机的成本超出所获奖励)；
- (c) 相关当局批准引入基于易燃制冷剂的制冷和空调设备的程序既耗时又复杂；
- (d) 存在反对使用基于易燃制冷剂的制冷和空调设备的宣传，使更多的人认为使用这类设备会产生风险；和
- (e) 在某些应用中，缺乏用于设备改型的低全球升温潜能值替代制冷剂。例如，在渔业方面，大多数船只的船龄在 25 至 35 岁之间，经常出现渗漏和维修问题；目前，没有合适可行的低全球升温潜能值替代方案可适用于这些船只。

示范替代技术的项目

26. 目前共有 12 个示范替代技术的项目正在实施。方法通常包括改型或更换在公共或私营机构运行的一台或少数几台制冷或空调机，以证明使用拟议的低全球升温潜能值替代物(即 R-290, CO₂)的安全性。在这些项目中，多边基金支付少数几台被改型或更换的设备费用，受益机构提供实物捐助，主要是为设备安装、维护和监测提供技术支助。表 3 汇总了从各机构提交的正在实施的示范项目报告中提取的信息。

表 3. 示范替代技术的项目

国家*	机构	次级行业/ 应用	替代技术	费用 (美元)		改型/ 计划	更换 迄今 为止	氟氯烃 淘汰 (公吨)	完成日期
				核准	共同出资				
智利	开发计划署	超市	跨临界 CO ₂	485,863	2,482,790	5	2	3.30	2018 年 12 月
哥斯达黎加*	开发计划署	冷藏室	CO ₂ /NH ₃	524,000	419,000	1	1	1.31	2018 年 1 月
厄瓜多尔	工发组织	冷藏室	R-290	暂缺	暂缺	1	1	0.03	2019 年 11 月
格林纳达	环境规划署	室内空调	R-290	9,000	-	2	2	暂缺	2018 年 12 月
伊朗伊斯兰共和国	德国	超市	R-290	415,000	-	2	3	暂缺	2014 年 12 月
毛里求斯	德国	超市	R-744	200,000	-	1	1	暂缺	2028 年 12 月
毛里求斯	德国	超市/供应链	R-290/ R-744	250,000	-	暂缺	暂缺	暂缺	2030 年 12 月
圣文森特和格林纳丁斯	环境规划署	商用空调	HC	99,800	-	2	2	暂缺	2026 年 12 月
土耳其	工发组织	冷藏室；超市 冷风机	CO ₂ /NH ₃ R-448A/ R-290 HFO- 1233zd	380,000	暂缺	3	1	0.09	2021 年 12 月
委内瑞拉玻利瓦尔共和国	工发组织	商用空调(冷风机)	R-290	暂缺	暂缺	1	1	0.008	2018 年 11 月
共计				2,363,663	2,901,790	18	14	4.72	

* 示范项目最终报告中的信息。已经确定了其他示范项目，包括阿根廷的超市(最后报告将提交第八十五次会议)和格鲁吉亚的超市(尚无关于实施情况的信息)。

27. 这些示范项目获得的支持是向技术人员提供培训，主要是让他们熟悉引进的替代技术、开展提高认识活动和其他支持活动，以确保在当地市场能够获得替代技术。例如，一个国家支持示范项目的方法是，对用基于 HFC-32 的设备替换的每吨 HCFC-22 和 R-410A 的制冷能力给予回扣，另外两个国家则通过了新的法规和标准，以确保做到安全处理引入的替代制冷剂的使用和维修。

28. 双边和执行机构报告的其他惠益包括：当地企业在应用风险评估方法和使用易燃制冷剂的系统运行中掌握了实际知识；新系统减少了能源使用(在一个案例中，减幅高达 30%)；有机会向各国利益攸关方展示新技术，以及开放当地市场迎接这些技术。

29. 由于信息有限，无法了解其他最终用户在多大程度上也因为这些项目而用自己的资金改型或更换其基于氟氯烃的系统；关于这些项目在实施过程中遇到的挑战的信息也很有限。

最终用户的减少泄漏方案

30. 只有一个国家的最终用户项目侧重于通过更换老旧低效的部件和使用更好的密封设备、阀门、管道连接和其他构件来改进两个超市现有氟氯烃系统的封闭做法。这种做法节约了能源，减少了对氟氯烃的需求。与设备和工具(如检漏仪、真空泵、钎焊和其他制冷设备组装配件)、工程和培训相关的费用由多边基金支付，受益超市支付了技术人员服务、消耗品和维修工具的费用。

31. 该项目实施后，每年 HCFC-22 的泄漏率从制冷剂充注量达 130% 降至零；系统的性能系数提高了 13.4%；降低了能耗。向超市技术人员提供了最佳做法培训，使项目得到了支持。此外，在该第 5 条国家的氟氯烃淘汰管理计划下，另有 4 800 名技术人员接受了与下列方面有关的最佳做法培训：密封系统设计、泄漏检测、钎焊、回收和复原、数据记录和计划进行的预防性维护。没有颁布具体的监管措施，因为该项目的范围是展示制冷维修行业的最佳做法。

32. 项目实施过程中遇到了一些挑战，包括：

- (a) 缺乏固定的检漏和监测系统部件和设备；
- (b) 有兴趣按照项目技术规格和要求参加投标和提供用品的供应商数量有限(不得不多次发布投标，延误了项目)；和
- (c) 设备交付延误，导致两家最初选定的超市退出。

秘书处的意见

33. 2010 年至 2013 年期间核准的与最终用户奖励计划有关的项目主要针对低消费量国家；针对非低消费量国家核准的与该计划相关的项目数量有限。考虑到氟氯烃淘汰管理计划第一和第二阶段⁴维修行业计划(包括最终用户奖励计划)下的可用资金额，很难对最终用户奖励计划中推广的低全球升温潜能值替代技术的可扩展性做出评估，除非在某个特定应用中确定了氟氯烃的使用量(如渔业中使用的 HCFC-22)，⁵ 或者一个或多个最终用户在证明了其性能后决定在其设施中采用替代技术(如超市中采用的基于 R-744 的技术)。

34. 市场因素，尤其是与下列各项有关的市场因素对实现奖励计划如愿渗入市场构成挑战：基于高全球升温潜能值含量、不含消耗臭氧层物质的制冷剂(例如制冷应用中的 HFC-134a、R-404A；或空调系统中的 R-410A 和 R-407C) 设备的可用性，⁶ 以及限制引入最终用户奖励计划中包含的基于氟氯烃的新设备的法规缺失。

⁴ 关于氟氯烃淘汰管理计划第一阶段第 60/44 号决定和关于氟氯烃淘汰管理计划第二阶段的第 74/50 号决定。

⁵ 渔业部门改型方案面临着一个挑战性局面，即能否获得安全的基于低全球升温潜能值制冷剂的替代技术。

⁶ 随着《基加利修正案》于 2019 年 1 月 1 日生效和越来越多的国家成为该《修正案》的缔约方，基于低全球升温潜能值制冷剂的制冷和空调设备的增长率正在攀升；技术和经济评估小组工作队在最近关于能效的报告中报告了这一增长情况。

35. 随着氟氯烃淘汰计划加快实施(例如,在2025年之前淘汰氟氯烃,而不是如几个第5条国家氟氯烃淘汰管理计划第一和第二阶段建议的,到2030年淘汰氟氯烃),氟氯烃供应量减少,加上实施了促进采用低全球升温潜能值替代技术的最终用户奖励方案,可导致加快减少氟氯烃消费量和逐步采用低全球升温潜能值技术。

36. 制冷和空调应用中非氟氯烃低全球升温潜能值技术选择的可用性有限,影响了最终用户奖励计划的扩展。到目前为止,与奖励计划涵盖的不同制冷和空调应用有关的技术选择仍在酝酿之中;当地市场的可获取性和成本效益选择仍然有限(例如基于HFC-32/R-290的空调设备或基于R-744的商用制冷设备)。这种情况正在发生变化,原因是在当地市场某些应用中的低全球升温潜能值制冷剂设备的可获取程度不断提高;与《基加利修正案》有关的活动(例如扶持活动)也在最近(即过去两年左右)这种技术的采用方面发挥了作用。

37. 根据几个第5条国家在氟氯化碳淘汰的最后阶段改造基于氟氯化碳的家用冰箱和独立商用制冷设备的经验,在核准氟氯烃淘汰管理计划第一阶段的早期阶段,最终用户奖励计划的主要目标之一是在具体的空调和制冷应用中改造基于氟氯烃的制冷设备。然而,在早期实施阶段,这些奖励措施或被推迟,或被重新设计,以优先考虑其他活动,如为技术人员提供更多培训或采购设备和维修工具,以支持维修车间和/或国家机构,原因如下:

- (a) 确保对设计用于非易燃制冷剂的设备进行安全的低全球升温潜能值改造的行业做法和流程的复杂性增加,包括在对技术人员进行设备改型的严格培训和能力建设,为技术人员进行此类改型的认证程序方面;
- (b) 用于监测将基于氟氯烃的设备安全改用易燃制冷剂的监管框架的修订过程漫长而耗时;
- (c) 可以获得选用高全球升温潜能值制冷剂(例如,用于HCFC-22空调的R-407C)以及基于高全球升温潜能值制冷剂的设备的改型备选方案;
- (d) 执行委员会通过了政策决定,以避免在把最初为使用非易燃制冷剂而设计的设备改型为使用易燃制冷剂时采取不安全做法(例如,第72/17、72/40和73/34号决定)。

38. 在一切照旧的情景中,市场因素将有利于采用新的基于不含氟氯烃的高全球升温潜能值制冷剂的设备(例如,基于R-410A的空调;HFC-134a或基于R-404A的独立商用制冷),以取代正在退役的基于氟氯烃的设备。没有在国家一级制定政策和法规限制使用新的基于氟氯烃的设备并鼓励采用低全球升温潜能值替代技术,影响了最终用户奖励计划的总体效果。可以通过促进采用低全球升温潜能值替代品(包括奖励计划下考虑的替代品)的法规和其他措施,以及氟氯烃淘汰相关措施,扩大最终用户奖励计划的影响。

39. 最终用户奖励计划下的受益方共同出资比例在50%至85%之间。共同出资数额表明受益方对采用该计划下的预定替代技术的承诺;然而,这并不能保证所采用的技术具有可扩展性,因为这些计划仅向数量有限的最终用户展示了替代技术的性能。将这些计划与导致设备更换的其他方案(例如,在电力公司支持下实施的巴西家用冰箱更换方案;墨西哥电器更换方案)联系起来,可使这些方案具有可扩展性(而且,从被更换的设备中回收的

HCFC-22 数量增加)，并指出，应将设备中采用低全球升温潜能值制冷剂包括在这些方案的设计中。

40. 为技术人员采用低全球升温潜能值替代技术进行的培训和能力建设活动是在最终用户奖励计划和培训方案下实施的，这些都是氟氯烃淘汰管理计划下的维修行业活动的一部分。增强的能力建设活动提高了利益攸关方对采用替代技术的信心。在某些情况下，向技术机构提供的设备支持为安全采用低全球升温潜能值替代技术提供了支持。

41. 在一个国家，最终用户奖励计划侧重于减少超市中的泄漏，导致 HCFC-22 泄漏大幅减少，设备冷却性能得到提高。如果在其他第 5 条国家推广这条经验，需要对最终用户和相关技术人员开展能力建设活动，以便对超市使用的商用制冷设备的泄漏情况进行详细评估，并采用减少泄漏、回收和再利用氟氯烃的良好做法。

建议

42. 谨建议执行委员会：

- (a) 注意到关于在核准的氟氯烃淘汰管理计划下供资的最终用户奖励计划的报告（第 82/54 号决定）的 UNEP/OzL.Pro/ExCom/84/63 号文件；
- (b) 逐案审议氟氯烃淘汰管理计划现阶段或未来阶段下的最终用户奖励计划，同时考虑到限制使用《蒙特利尔议定书》受控物质的政策框架，并支持采用在奖励计划下拟议的替代技术，以及拓展根据当地市场情况提出的替代技术；
- (c) 请双边和执行机构在提交上文(B)分段所述最终用户奖励计划时：
 - （一）在可行的情况下，设计具体制冷和空调应用的最终用户奖励计划，以加速淘汰此类应用中使用的受控物质，并促进尽早采用拟议的替代技术；
 - （二）视需要制定法规和其他措施，限制受控物质的使用，并促进尽早采用在已确认的应用中提议采用的替代技术；
 - （三）提供信息，说明参与奖励计划的所有受益最终用户共同出资的实际数额，并说明他们为促进采用拟议的技术而将采取的行动；
 - （四）接纳培训、能力建设和技术援助，以便以具有成本效益的方式采用拟议的替代技术，同时考虑到与核准的氟氯烃淘汰管理计划下实施的培训方案的协同增效；
 - （五）预测最终用户奖励计划在淘汰受控物质和逐步采用替代制冷剂方面的影响；和
- (d) 请双边和执行机构在现行最终用户奖励计划完成后提交关于计划的详细报告，包括为促进采用替代技术而采取的行动，秘书处可在此基础上编写可在项目执行期间使用的情况简报。

附件一

与氟氯化碳淘汰期间执行改型、设备更换和最终用户奖励计划有关的决定

1. 执行委员会第二十八次会议通过的商用制冷行业最终用户转型准则(第 28/44 号决定)规定,在优先进行最终用户转型活动之前,必须先考虑以下相关情况:

- (a) 关于氟氯化碳和基于氟氯化碳的设备的生产和进口管制措施已经到位并得到有效执行,新的氟氯化碳部件的安装受到限制;
- (b) 国家剩余消费量主要用于制冷和空调设备的维修;
- (c) 关于所有剩余消费量情况的全面数据已经确定,并提交给了执行委员会;和
- (d) 或者没有其他可能的活动能够使有关国家履行其氟氯化碳管制义务,或者氟氯化碳消费价格已在至少九个月内高于替代制冷剂的价格,且预计还将继续上涨。

2. 在第三十一次会议上,执行委员会决定,可以根据第 31/48 号决定提交鼓励改型的奖励方案。随后,在第三十二次会议上,开发计划署提出了商业和工业最终用户制冷设备改型/更换奖励方案的概念,并提交了三个项目,执行委员会决定,除其他外,在某些条件下,可以在一项制冷剂管理计划内为鼓励制冷设备改型的奖励方案提交项目提案(第 32/28 号决定)。

3. 在执行委员会第三十一和三十二次会议作出决定三年后,于 2003 年对制冷剂管理计划的执行情况进行了评估。评估结果报告了在到访的几个国家(加纳、塞内加尔、乌拉圭)对家用和小型商用电器进行改用碳氢化合物的试点测试,这些测试被视为是一项潜在选择,即在氟氯化碳淘汰后可继续以有限成本运行基于氟氯化碳的冰箱。这就要求对技术人员进行强化的安全培训和对车间进行改造,据称能效将会提高,尽管这一点没有记录在案。在大多数情况下,将冰箱改用 HFC-134a 在经济上并不可行,因为其成本相对较高,酯油成本较高,且处理系统存在困难。无须改造设备的制冷剂在当时被认为是值得探索的有用的过渡解决方案。

4. 本次评估期间收集到的关于最终用户转型的有限证据再次表明,如果具备以下要素,奖励方案原则上可能是有效的:带有配额分配的可操作有效的进口许可证制度、对氟氯化碳消费量的可靠控制、氟氯化碳与替代制冷剂之间的价差缩小甚至倒置、对工商业公司提供的经济奖励,以及最后但同样重要的经济增长,这有助于为投资的现代化调动公共和私人资金。评估还得出结论认为,对市场发展的预期,而不是提高认识,可以促使私营部门着手进行技术转型,这意味着要进行额外的投资,并需要进一步分析成功的因素。

5. 到 2007 年,已经核准了 20 个制冷最终用户奖励方案,随后对促进改型的奖励方案进行了案头研究。该项研究证实,一个国家有可能也必须满足执行委员会为核准奖励方案而规定的先决条件,即:氟氯化碳和基于氟氯化碳的设备的生产和进口管制措施已经到位并得到有效执行,同时限制开发新的氟氯化碳部件。研究进一步证实,如果没有这些先决

条件，与潜在受益者进行必要的密切合作是非常困难或难以实现的，这正是一些国家所经历的。本次评估中观察到的项目延误的主要原因是，缺乏成功启动奖励项目的必要先决条件。¹

6. 该项研究表明，最终用户奖励方案中考虑了一系列替代品，包括改型为 HCFC-22、HFC-134a、HFC-404A、碳氢化合物，或无需改造设备的制冷剂 HFC-406、HFC-409 和 C-10M1。奖励方案的受益企业确认，由于 HCFC-22 的价格较低(在所有情况下，均在 CFC-12 价格的 20%至 52%之间)，转型带来了巨大的经济效益。在转用 HFC-134a 或 HFC-404A 的情况下，制冷设备业主认为，尽管目前新的替代品每千克的价格高于 CFC-12，但新系统运行效率带来的经济效益远远超过制冷剂价格的差异，应该成为转用新替代品的动力。由于可用性低，成本高，特别是考虑到老化制冷设备泄漏率高，当时利用含氟氯烃的三元混合物进行的无须改造设备的转型在第 5 条国家的应用率有限。几乎所有公司都报告说，制冷剂泄漏和常见故障已经减少或完全停止，大大减少了运营费用和储存产品的周期性损耗。

7. 促使最终用户改造其设备的一些因素包括：现有设备剩余寿命有限和维护费用增加；CFC-12 制冷剂价格上涨而 HCFC-22 价格相对较低；业主对消耗臭氧层物质淘汰和未来氟氯化碳制冷剂出现短缺的认识提高；获得奖励方案资金的程序相对简单；对转型产生额外惠益的认识提高，例如，节能、维护费用降低、泄漏减少，以及更换或改型后的制冷设备性能更好，从而出现了与此相关的新商机。通过对现有设备的改型，延长了设备的使用寿命，推迟了食品加工工业对设备的本不可避免的投资；可获得替代技术和为更换和改型提供优质服务的当地承包商；地方顾问通过国家制冷协会，与维修技术人员和当地制冷承包商建立了良好的联系。

8. 2009 年，有关最终淘汰管理计划的评估得出结论认为，凡在 CFC-12 价格飞涨而同样可利用的替代品价格稳定的地方，促进改型的奖励项目效果良好。评估还认为，价格差异、奖励程度和国家臭氧机构的相关活动也发挥了重要作用。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
4.	Croatia	UNIDO	5
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6.	Fiji	UNDP	7
7.	Ghana	UNDP	8-9
8.	Madagascar	UNIDO	10
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10.	Maldives	UNDP	12-13
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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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8.	Saint Vincent and the Grenadines	UNEP	26
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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	
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. 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.		
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
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)	
Main results obtained and any other environmental/economic impact achieved: 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.		
Reasons for delay. If the project was discontinued, please explain the reasons and indicate to what activities the funding was reallocated: 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.		
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.
Comments on the reasons for success of failure of the project and recommendations: 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. 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. 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.	

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: - 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 be 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
	- 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	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. 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%.
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.
Comments on the reasons for success of failure of the project and recommendations: • 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: 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 \$)	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: 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. The project objectives are: - 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: - 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	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: - 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
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. 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. 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.	
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	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: • 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	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. 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.

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.
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. 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.	

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
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) The HPMP for Mauritius was approved already at the 63 rd 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 3 rd 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.	
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) NA	
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	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	
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	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: The HPMP for Mauritius was approved already at the 63 rd 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 CO ₂ technologies. So instead, a demonstration unit for CO ₂ use in the supermarket sector was designed specifically for the UDM (the local university). 2 trainings systems have been provided one working solely on CO ₂ , another a cascade system using Ammonia and CO ₂ . 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 CO ₂ .	
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) Mauritius has become one of the few countries in the world that has a state of the art CO ₂ system at a local training institute. This unit has allowed graduating technicians to gain hands-on training on how to work with CO ₂ . 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.	
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
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. 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.	
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
Main results obtained and any other environmental/economic impact achieved: 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. 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. 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.	
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	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.
Comments on the reasons for success of failure of the project and recommendations: 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. The strengthening of human resources and technology will allow replicating this experience in a simple and fast way.	

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: Summary of the main findings from the first two interventions: - Annual leakage rate before the project: - 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: - 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: 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: 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
- 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: - 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.	