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环境规划署

Distr.
GENERAL

UNEP/OzL.Pro/ExCom/58/9
11 June 2009

CHINESE
ORIGINAL: ENGLISH

执行蒙特利尔议定书
多边基金执行委员会
第五十八次会议
2009年7月6日至10日，蒙特利尔

关于评价冷风机项目的案头研究

执行摘要

1. 到目前为止，存在若干类资助下开展的冷风机项目：早期特定改型或替换项目，早期探索创新性新办法的项目，执行委员会第四十七和第四十八次会议所做决定提出的项目，以及作为国家淘汰计划或结束性淘汰管理计划一部分的冷风机项目。

2. 迄今，多边基金还从未对各类项目做出过系统的评估。本案头文件对基金秘书处现有的 90 多份项目文件和报告进行了审查和分析，目的在于仔细检查多边基金所做努力，特别是在与其他机构提出共同供资方案方面的努力。所取得的经验、解决和未解决的问题，以及吸取的教训都非常有用，而无论将来是否审议冷风机替换方案。

3. 到目前为止，仅有少数几个国家项目通过赠款和循环基金体系实际完成了相当数量的冷风机替换，即在墨西哥、泰国和土耳其开展的项目。这些替换项目是在不同条件和机制下实现的，通常都有完全不同的国内激励措施。尚不清楚是什么因素决定了这些资金部分取得成功或没有取得成功，或为什么它们仅对国内一部分冷风机所有者具有吸引力。

4. 2005-2006 年，执行委员会为冷风机示范项目核准了 1,590 万美元资金。如果研究到目前为止所取得进展，并不能发现真正的激励因素以延续这种办法，更无法探索可能的共同筹资计划。在此阶段，这些项目不可能很好地表明共同筹资意味着什么。

5. 本案头研究的一个关键目标是审查一些可用的文件，文件内容涉及各国寻找各类筹资来源的经验，以及所遭遇的障碍。从已获取的信息中，可以得出一些结论；但是，看来在第 5 条国家间根本不存在一个一致的机制。

6. 迄今所取得的有限经验表明，在许多国家，节能以及减少氟氯化碳供给应是促成冷风机替换的充分激励因素。但是，很显然的是，这不可能在所有国家都起作用，并且肯定不会足够快速到在 2009 年底之前消除在冷风机中使用氟氯化碳。替换所有合适的使用氟氯化碳离心冷风机很可能还需要很多年。

7. 尽管认为大量使用氟氯化碳离心冷风机仍在许多第 5 条国家运转，但即使经过多年替换后，数量估计仍将很庞大，许多问题仍然并不清楚：

- (a) 所有这些冷风机中，哪一部分仍需要替换；
- (b) 在没有金融工具介入的情况下，全球有多少冷风机已被改型或替换；
- (c) 有多少使用氟氯化碳的冷风机已不再运转；
- (d) 有多少冷风机每年运转时间的比例较小，在这种情况下，其短期财政节余将大大小于全年大部分时间满负荷运转的离心机的财政节余。

8. 后者很可能已经成为、并且还将继续是造成使用氟氯化碳离心冷风机的所有者，进

行转换或不进行转换的非常重要的理由。对于运转时间比例相对较低的情况，2-3 年相对较短时期内的财政结余将相对较少，远远少于偿还购买新离心冷风机，外加必要辅助设备的总投资额 60%-80% 的贷款。这个问题很可能是造成许多冷风机所有者不愿同意替换离心冷风机的重要原因。使用一些更小型的非离心（螺杆和涡旋压缩机驱动的）装置替换离心冷风机，本可以是一种更具吸引力的选择（即使在某些情况下使用氨），但有关这个特定问题的技术资料难度很大，要不就是难以找到。

9. 关于第 5 条国家氟氯化碳淘汰办法，还值得注意的是，由于使用氟氯化碳离心冷风机中仍然在消费氟氯化碳，因此各国并没有报告在整个淘汰进程中遇到的困难。问题是，国家淘汰计划或结束性淘汰管理计划下，是否已经包括了一部分确实存有问题的少数离心机，或是否认为这些离心机的问题已经解决。

10. 作为首个初步结论，可提及的是，如果双边或执行机构能够为清洁发展机制或自愿碳标准确定离心冷风机项目，他们无疑会继续探索这条途径。但是，如果在以后将发放正规的核证减排量（CER）信用（这需要事先得到来自政府或其他实体，为说服冷风机所有者替换设备所做的担保），就会出现管理上的缺陷，而且会减少吸引力。

11. 其次，除非第 5 条国家能提供令人信服的证据，表明挑选出的仍在运转的冷风机清单（包括它们的运转历史）可以证明此类机制的效力，否则就无法寻求多边基金介入或其他金融实体为替换使用氟氯化碳的冷风机提供循环基金赠款，这看来也是合理的。鉴于本研究中提及的所有限制条件和拖延情况，这是不可能做到的。

12. 不管是否存在真正的问题，或该问题是否已在《蒙特利尔议定书》财务框架外基本得到解决，但问题的程度仍不完全清楚。一个可以对现实做出更好评估的办法，是采取任何进一步行动的必要条件，如果要采取行动的话。

13. 随着第 5 条国家开始淘汰氟氯烃，相应的问题也产生了，即是否应考虑替换使用 HCFC-22 的冷风机设备（这种设备容量比使用氟氯烃或氟氯化碳的离心机更小），以及以何种方式从技术上解决这个问题。在此阶段，如果不指明各种具体的解决方案，需要指出的是，设备还将、而且可能会在未来若干年继续保持运转。既然非第 5 条国家也将以同样的方式应对技术解决方案，因此可得出结论，第 5 条国家和非第 5 条国家应齐头并进，因为类似的问题会在将来出现。

14. 任何淘汰使用 HCFC-22 的冷风机的活动，应回避需要替换或曾经需要替换的使用氟氯化碳离心冷风机所出现的复杂问题。事实上，使用氟氯化碳离心冷风机的问题在《蒙特利尔议定书》范围内有着自己的特殊性，这并没有促成进一步的透明。起初，看来可能的最好方式是将 HCFC-22 冷风机作为国家氟氯烃淘汰进程的组成部分，在这种情况下，氟氯烃淘汰管理计划应详尽阐述各类设备的转换，同时设定明确的目标。

一、案头文件进程

15. 编制有关评价冷风机项目的案头文件是 2008 年监测和评价方案的一部分，由执行委员会第五十六次会议批准（第 56/8 号决定）。本案头研究和相关个案研究的一个关键目标，是进一步研究这些国家在寻求各类共同筹资来源方面的经验，以及分析所取得成就，包括经历的障碍。

二、背景和目标

16. 冷风机应用于诸如机场、医院、大型购物中心等大型商业建筑及综合建筑，以及诸如食品和饮料行业、化学加工、制药配方、塑料工业和半导体制造等工业设施中。冷风机需要大量投资，这取决于冷风机类型、应用领域、功率和使用的控制系统。这类投资或用于改型现有冷风机，或使用新的无消耗臭氧层物质冷风机替代原来的冷风机。

17. 第 5 条国家冷风机的数量及其使用期限的分布情况并不清楚。非第 5 条国家在 1993-1994 年前一直在生产氟氯化碳冷风机。一些发展中国家或许还在更长的时间里生产氟氯化碳冷风机；来自制冷专家的轶事报告指出，甚至在 2007-2008 年，还在生产新的使用氟氯化碳离心冷风机。但是可以肯定的是，过去十年的产量并不大。

18. 第 5 条国家可采用三条基本途径，履行它们淘汰冷风机行业使用的氟氯化碳制冷剂消费的义务。这三条途径是：改型、替换和制冷剂遏制。最后一项制冷剂遏制包括在国内分销商或个别冷风机所有者等持有的再循环及储存的制冷剂，以及可能连同虚拟的储存机制。在冷风机替换选项下，建议执行委员会批准替换使用氟氯化碳的冷风机，作为冷风机行业消耗臭氧层物质淘汰的第一优先战略选择，同时在计算替换的增支成本时，将节能考虑在内。但是，所有这些项目类型都是多边基金供资的冷风机项目详细目录的一部分。

19. 原则上，更新的使用氟氯化碳的冷风机可考虑进行改型，因为这提供了减少运转和维护费用的机会，并同时提高了制冷设备的性能。选择氟烷还是氟氯烃取决于正考虑改型的冷风机中包含的氟氯化碳类型。即使冷风机的某些部件必须替换，但冷风机改型费用比冷风机替换费用少 30%-60%。改型是一种令人感兴趣的转换选项；但是，只有在水冷式冷风机最昂贵部件压缩机状态良好，以及使用氟氯化碳的旧冷风机有良好的功效，即低于 0.75 kW/kW 时，才能采取这种方式。

20. 如果使用氟氯化碳的冷风机非常陈旧，技术状况非常差，频繁发生故障并且制冷剂泄漏率非常高（因此运转效率更低），则永远不可能改型成功。一般原则是，如果冷风机使用时间超过 12-15 年，不应对其冷风机进行改型。

21. 有各种新型离心冷风机可以使用并进行安装，这取决于技术条件和区域特点，包括气候条件、当地工程公司的能力、技术普及、现行法规和金融体制。冷风机可采用空气冷却式或水冷式。特别是，必须根据它们在工业设施或商业和公共建筑行业的指定运转领域来选择冷风机类型。与空气制冷冷风机相比，水冷式冷风机结合使用冷却塔，提高了冷风

机系统的热力学效力。水冷式冷风机可使冷凝器温度不变，这个温度比空气制冷系统的温度更低。因此，实质上空气制冷冷风机的能效更低。

22. 到上世纪 90 年代中期，对冷风机替换进行了研究，例如由世界银行臭氧行动资源小组（OORG）进行的研究。随后所有环境规划署制冷、空调和热泵技术选择委员会评估报告（RTOC 评估报告，1994 年、1998 年、2002 年和 2006 年）都叙述了冷风机替换选择。工发组织 2008 年期间出版的报告也提出了冷风机替换和供资途径，该报告还叙述了 2007 年举行的研讨会的过程。还开展了更多的研究，并举行了许多有关冷风机替换的研讨会；但是，总的结论是所有这些努力获得的最后成果并没有给人留下深刻印象。下文还将对此做出进一步分析。

23. 没有关于所有第 5 条国家使用氟氯化碳离心冷风机总数的精确和最新的统计数据。2004 年技术和经济评估小组冷风机特别工作组报告提供了一项评估。这项评估指出，第 5 条国家仍有 15,000 台使用氟氯化碳离心冷风机在运转；这些冷风机中的制冷剂总量估计至少为 6,000 ODP 吨。根据对多个第 5 条国家使用的离心冷风机氟氯化碳消费量的分析，可得出这样的结论，即所有安装的冷风机的泄漏率在 20%至 40%之间，许多冷风机已经非常陈旧，也就是使用年限在 25 至 30 年以上。这意味着当前大约 1,500 ODP 吨氟氯化碳消费量被用于维修这些冷风机，这占 2007-2008 年制冷维修行业剩余氟氯化碳消费量的 5%。

24. 假设目前使用氟氯化碳的冷风机的平均使用时间为 15 年至 20 年，那么其中许多冷风机原则上还将再使用 10 至 20 年。但是，根据泄漏率为 25%的假设（平均每台冷风机氟氯化碳存量大约为 500 公斤），这将需要大量氟氯化碳存货。这使得再使用 10 至 20 年的假设变得非常不可能。

25. 2004 年技术和经济评估小组冷风机特别工作组估计冷风机数量为 15,000 台，这很可能估计不足。所有第 5 条国家离心冷风机的总数可能在 15,000 至 20,000 台之间。所有冷风机中，预计很大比例的冷风机将不再运转。很大比例的离心冷风机还可能每年运转时间比例不到 25%，在这种情况下，就很怀疑平均每年泄漏的量是多少，以及一旦冷风机运转起来，是否还会真正起作用。

26. 每年运转时间比例不到 25%，也会造成与旧冷风机相比，新冷风机只会节约相对很少的电力（这在很大程度上还由各国电价体系决定），这就是冷风机所有者不大重视替换选择的一个原因。如果替换还涉及偿还为此筹资的贷款，情况将尤其如此。

27. 同样非常不明确的是，某些冷风机所有者是否决定将使用氟氯化碳改为使用碳氢化合物，即所谓的“简单改型”。就 CFC-11 来说，可使用戊烷或异戊烷，而对于 CFC-12 来说，丙烷异丁烷混合物或添加二甲醚效果会很好。此处安全问题十分重要，但本文件并未对此进行讨论。2008 年 4 月，在蒙特利尔组织的氟氯烃淘汰研讨会上，澳大利亚一家企业的报告提出，亚洲许多冷风机显然已经被改型，转而使用碳氢化合物。

28. 1994 年，估计美国有 80,000 台使用氟氯化碳离心冷风机在运转。¹ 2003 年的报告指出，大约 30,000 台使用氟氯化碳的冷风机仍未进行改型或替换²；对于这些冷风机，改型选项已不再具有多少吸引力。在美国和其他发达国家，1993-1994 年就停止生产离心冷风机；仍在运转的离心冷风机的使用时间现已超过 15 年。在运转多年后，鉴于改型后的冷风机的功效会比新冷风机的功效更低，因此改型的代价相当高。改型费用超过了使用新设备所节余下来的费用。

29. 根据上述数据可以估计，美国当前肯定还有大量使用氟氯化碳离心冷风机在运转（15,000-20,000 台）。但是，可以认为余下的使用氟氯化碳的冷风机每年运转时间比例会很低，这使得新产品在运转费用方面的优势不再具有说服力。只要可以获得库存的氟氯化碳材料，也就不能说服冷风机所有者替换各类氟氯化碳，正如所报告的，美国就是这种情况。³

30. 正如 UNEP/OzL.Pro/ExCom/37/34 号文件中指出，现代化的冷风机与旧冷风机相比，在能源消耗方面，效率非常高。对于替换一台使用 35 年的旧冷风机来说，报告称功效增加了 35%-45%。但是，世界银行和其他机构进行的研究表明，尽管因节能带来的投资回收期很短，但许多第 5 条国家都没有进行替换。若干多边基金赞助的冷风机项目都被拖延，据报告称是因为在筹集对应出资方面遇到了困难。

三、执行的项目

31. 执行委员会和许多发展中国家在很长一段时间，已经意识到了与替换使用氟氯化碳的冷风机相关的担忧和挑战。核准的冷风机项目有若干类型：

- (a) 试验创新性筹资机制的早期个别冷风机项目（墨西哥和泰国）；还有许多技术援助和培训项目（见附件二第二部分）；
- (b) 作为国家淘汰计划（阿根廷、巴西、哥伦比亚、厄瓜多尔、马来西亚、墨西哥、泰国和土耳其）和结束性淘汰管理计划（巴林、洪都拉斯、牙买加、毛里求斯和蒙古（见附件二））组成部分的冷风机改型和替换项目；
- (c) 在执行委员会第四十七次会议及之后的会议上，核准了一系列示范项目；开发计划署正在拉丁美洲（巴西、哥伦比亚、古巴和委内瑞拉玻利瓦尔共和国）执行这些项目；

¹ 资料来源：美国冷风机制造商，材料源自 2004 年技术和经济评估小组冷风机特别工作组报告。

² 资料来源：同上。

³ 技术和经济评估小组及多边基金秘书处调查的问题，与向美国之外有可能出现不合规行为的国家提供再循环的氟氯化碳材料有关——2009 年 5 月。

- (d) 工发组织在非洲（喀麦隆、科特迪瓦和埃及）、西亚（阿拉伯叙利亚共和国）和欧洲（克罗地亚和前南斯拉夫的马其顿共和国）开展的项目；以及世界银行在全球技术援助项目下在中国、印度和菲律宾开展的项目（见附件二第一部分）。

32. 正如在 UNEP/OzL.Pro/ExCom/56/11/Add.1 号文件中指出的，在执行委员会第四十五次会议为冷风机行业核准的 1,520 万美元专用款下，为大多数冷风机示范项目核准供资三年之后，据报告在某种程度上取得了显著进展，但无疑还不能令人满意。与现有得到多边基金全额补助供资的项目相比，获得对应共同筹资的冷风机项目的执行，在某种程度上更为缓慢，但获得供资比核准项目时所需最低资金更高。尽管准备时间很短，但各机构都能按照最初提交材料中所预见的那样向项目预付款项，但对于许多项目，即使在核准三年后，一台冷风机也没有替换。根据工业化国家的经验，使用氟氯化碳的冷风机在未来一段时间可能还将继续使用，需要对它们进行替换，以结束对 CFC-11 的主要使用。

四、冷风机项目模式

33. 在早前的项目中，对冷风机替换使用了多种供资模式。与全球环境基金（全环基金）共同筹资的泰国冷风机项目，与当地金融机构共同筹资的墨西哥冷风机项目，以及作为氟氯化碳国家淘汰计划一部分的土耳其冷风机替换项目，获得了大量的经验，这些经验主要是关于多边基金如何与其他金融机构合作，所遇到的障碍以及如何解决，如何在任务规定中互为补充，以及不同组织的运作程序和行政安排如何影响调动共同筹资取得成功、其费用和时机等。其中一些机构是多边性质的，例如全环基金，而其他机构是私营机构，有着不同的筹资标准和办法。

34. 提交给执行委员会第五十六次会议的一份冷风机项目进展报告（UNEP/OzL.Pro/ExCom/56/11/Add.1 号文件），以从开发计划署、工发组织和世界银行获得的信息为基础，描述了有关调动共同筹资和转换冷风机的示范项目的当前状况。

35. 工发组织能够从双边来源和冷风机所有者那里调动共同筹资，并且预付款项相对迅速。在欧洲，12 台规定替换的冷风机中，已经替换了 5 台，再替换 5 台的工作正在取得进展。在阿拉伯叙利亚共和国，所有 3 台规定替换的冷风机原定在 2008 年 10 月替换，据报告，另外 4 台冷风机的改型正取得进展。开发计划署为获得全环基金理事会和私营部门审批的共同筹资，花费了 19 个月。全环基金首席执行官的最后认可仍然悬而未决。迄今还未对规定的 12 台冷风机进行替换。

36. 世界银行全球冷风机项目被核准在 7 个国家执行（中国、印度、印度尼西亚、约旦、马来西亚、菲律宾和突尼斯）。迄今世界银行的活动重点，是确保印度和菲律宾的冷风机替换项目的共同筹资。这些项目旨在使用来自多边基金和全环基金的资金，向冷风机所有者提供平均 20% 的激励。作为回报，这些冷风机所有者将向项目交出将来碳信用的所有权。在清洁发展机制下，预计从这些碳信用所得的收入将被用于激励替换更多冷风机，以及向项目管理费用提供资金。其中包括技术援助部分。冷风机所有者、金融机构和其他合作伙

伴做出了积极回应，但需要提出的是，迄今尚未进行转换。只能猜测其中的原因是缺乏技术和工序方面的资料。

37. 冷风机替换项目的总数只能大致进行估计。从墨西哥、泰国和土耳其的项目以及一系列更小的项目来估计，实现的替换总数将为 250-350 台。在没有外部介入的情况下，许多冷风机可以获得改型或替换。2004 年估计有总数超过 15,000 台的使用氟氯化碳离心冷风机，总数的下降不可能非常显著，也就是说，在第 5 条国家，可能仍然还有 13,000 至 15,000 台离心冷风机。

38. 但是，由于第 5 条国家在实现 2010 年氟氯化碳淘汰目标中，没有报告遇到的困难，许多冷风机将不再运转，对未经确认的化学品或冷风机，一定还有更多的改型，而且冷风机维修必须被看作是属于氟氯化碳行业，事实上这很难理解。这些问题使得整个剩余冷风机的替换问题非常难以量化。最后的可能是，冷风机所有者认为这个问题并不急迫，因为运转时间比例很低，替换不会像预想的那样带来节余。

五、障碍

39. 1995-2008 年期间拟定的所有报告都描述了遇到的障碍。事实上，这些年来这些障碍并未得到改变，并使冷风机的替换问题变得非常特别。

40. 被指出对冷风机替换造成障碍的问题包括：高额的初始投资费用、缺乏有利的政府政策、技术性的专门技能不足，以及获得财政支助受限，特别是在离心类型更为昂贵的情况下。示范项目在独立执行和向此类项目供资中，给予了地方商业银行、供应商和项目促进者更多的支持和灵活性。

41. 为促进使用氟氯化碳的冷风机的早期淘汰，重要的是解决两个障碍——高额的预先投资费用和感觉到的通过应用新技术实现节余的风险。

42. 尽管节余通常涉及到能源消耗的减少，仅此就使得替换旧冷风机在经济上是一种可行的选择，但在没有额外的外部刺激情况下，通常不会进行此类替换。不愿替换的可能原因是：

- (a) 对宣称的更低能源消耗缺乏信任；
- (b) 建筑物被出租，因此投资和运转费用由不同实体支付；
- (c) 不能获得任何投资预算（特别是公共建筑物）；
- (d) 替代品投资比冷风机替换具有更好的投资回报；
- (e) 缺乏对迫切需要改变的感知；

- (f) 很难获得供资，或贷款费用高得惊人。

43. 世界银行发现，30%的贴现率使得印度的冷风机所有者有最好的表现。世界银行认为，在决定项目和执行冷风机示范项目所需的具体国家供资水平的过程中，应考虑到关于冷风机替换惠益的具体国家和具体冷风机框架条件。世界银行的数学和业务模型是当前进行此类计算的唯一可获得依据。一个重要的后果是，冷风机项目依赖国内条件，需要获得相关的冷风机替换费用的大约 10%至 25%的供资。剩余费用需要因替换所带来的其他惠益予以解决，特别是节能。

44. 审查文件揭示了以下额外的障碍：

- (a) 最终用户缺乏对现有法规的了解。最终用户通常并不清楚，如何将政府法规恰到好处地应用于冷风机和具体的装置/业务。这阻碍了在使用氟氯化碳冷风机的使用年限前对其进行改变；
- (b) 高额的投资费用。公共部门的资本支出非常典型地依赖预算拨款，因此不可能拥有冷风机替换的预付资本；
- (c) 对于那些负债的国家，通常在获得新的供资上有着严格的限制。公共部门通常不被允许出租冷风机，同样不允许私下向它们提供资金；
- (d) 当电力价格非常低的时候，没有足够理由让人们信服冷风机转换，特别是对于公共部门小型冷风机所有者。获得甚至价格更低的工业能源的用户，即使将来不能获得各类氟氯化碳，也不会注意到转换所带来的经济激励；
- (e) 在冷风机运转时间比例很低的时候（或许还伴随有电力价格很低），没有足够理由让人们信服冷风机转换。使用者不会意识到经济激励，或是会注意到必须在短期内偿还贷款面临的困难，即使在将来无法获得各类氟氯化碳；
- (f) 私营部门更有可能向增加收入，而不是减少费用的活动投资。除高额的设备费用之外，私营部门冷风机所有者还必须支付极高的进口税，某些情况下，进口税几乎达到设备费用的 45%。

六、冷风机项目执行中的拖延

45. 许多冷风机项目都出现拖延（例如印度、马来西亚、泰国、委内瑞拉玻利瓦尔共和国和越南），文件中提出的理由具有很大差异。例如：

- (a) 项目设计缺乏灵活性；
- (b) 拥有多台冷风机的所有者需要多个单独的项目文件；

- (c) 尽管需要，但是还没有技术援助预算；
- (d) 项目担保要求过于复杂。在泰国，这个理由被用于解释为何多个项目所有者选择进行额外的冷风机转换，而不使用项目窗口；
- (e) 对新的冷风机技术缺乏信心；
- (f) 就如何废弃和/或拆除现有冷风机没有明确方向；
- (g) 许多企业表示，只要仍然有可用的各类氟氯化碳，就不愿投资，因此必须要求对氟氯化碳的供应进行限制；
- (h) 与容纳替换的冷风机所需的建筑物改造有关的拖延；
- (i) 与冷风机项目资源分配不充分（没有足够人力从事该项目）有关的拖延；
- (j) 缺乏机构间协定（例如，墨西哥）；
- (k) 一些人将冷风机替换看作第二优先类别。酒店会首先投资便利设施、室内装修和翻新。据称，说服该行业企业家参与这个项目存在困难；
- (l) 缺乏政策驱动以确保冷风机的转换，不管是从消耗臭氧层物质或能效角度。要求替换使用氟氯化碳冷风机或推动无氟氯化碳冷风机进行替换的立法和/或规章没有制定；
- (m) 在协商违约条款上出现的拖延；
- (n) 个别贷款机制（例如，世界银行）是新出现的，执行机构需要新的指导方针和条例，因为这个项目必须应付许多个别的企业家，所以以前的指导方针不再适用；
- (o) 就泰国来说，能源部提出了若干财政补贴计划，以提高能效，特别是针对使用新的高能效无氟氯化碳冷风机替换旧冷风机。私营部门认为这些激励措施比多边基金项目提供的激励措施更有吸引力，因为利率非常低，而且偿还期限更长，没有要求拆除旧的使用氟氯化碳冷风机，也没有要求为新的冷风机安装数据记录器。

46. 对于冷风机行业，已经核准和完成了 7 个投资项目；到 2007 年底，总共仅核准了 1,473,219 美元（54.3%）。此外，核准了 18 个非投资形式的冷风机项目（示范项目和技术援助项目），共计 15,337,314 美元。当前完成了 6 个项目，迄今支付了核准资金的 8.6%。此外，冷风机替换项目在多个国家（例如阿根廷、墨西哥和土耳其）作为氟氯化碳国家淘汰计划或结束性淘汰管理计划的一部分而获得了供资。这表明，这种类型的项目很难执行，即使一旦获得核准，在各类因素改变的同时，也会出现很多拖延。下表列明了提到的进展。

多边基金下核准的冷风机项目

机构	核准项目数量	已完成项目数量	核准资金总计(美元)	支付资金总计(美元)	核准 ODP (吨)	淘汰 ODP (吨)	收到的项目完成报告
投资项目							
总计	7	7	2,708,783	1,473,219	65	67	6
世界银行	4	4	1,803,443	604,496	55	55	4
双边	3	3	905,340	868,723	10	11	2
非投资项目 (示范和技术援助)							
总计	18	6	15,937,314	1,319,926	105	4	5
世界银行	2	1	7,590,629	706,017	105	4	1
开发计划署	5	1	4,059,353	75,000	0	0	0
环境规划署	1	0	200,000	0	0	0	0
工发组织	3	0	2,402,535	33,839	0	0	0
双边	7	4	1,684,797	505,070	0	0	4

资料来源：2007年进度报告。

七、离心冷风机项目的供资和共同筹资

47. 向冷风机替换供资有多种方式，这与提高能效有着很强的联系。它们可在多边基金或类似机制下作为示范项目获得供资。也可使用清洁发展机制或自愿碳标准供资进行替换。清洁发展机制和自愿碳标准都采用相同的程序和方法，这已经得到广泛审查；它们发放与碳相关的信用，而来自清洁发展机制的信用价值高于来自自愿碳标准的信用价值。但自愿碳标准的运作更为灵活。

48. 冷风机替换作为《京都议定书》下小规模清洁发展机制项目，符合资助条件。在国内为替换冷风机而使用清洁发展机制的恰当方式是通过一个活动方案，这是因为初始编制和交易成本很高，因此一个基于单个冷风机替换的清洁发展机制项目看来并不可行。因核证减排量带来的能效收益可进行出售，以促成向冷风机替换筹资。为获得这项捐款，冷风机运营者必须利用主管公司的服务，以向《京都议定书》清洁发展机制执行理事会和各国指定国家机构拟定必要的文件。

49. 这个办法造成了基于单个项目的交易成本，并包含拟定项目文件的费用，确认和核实费用，以及执行理事会要求的项目注册收益份额和发布核证减排量的费用。以单个项目为基础计算的高额交易成本使得执行单个项目很不合算。此外，一台冷风机通常的能效收益所获得的核证减排量不适于销售。

50. 最相关的全环基金项目是世界银行拟定的“加速冷风机替换方案”。该项目旨在确保印度低能效的大型冷风机（100 吨或以上制冷剂容量）的早期替换。更多有关核准基线和监测方法的详情“通过替换高能效冷风机节能”见《气候公约》网站，<http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html>。

51. 对于执行委员会第四十七次和第四十八次会议决定提出的项目，到目前为止正在考虑共同供资或已经启动，主要通过以下来源：

- (a) 已建议全环基金作为全球冷风机替换项目和巴西、哥伦比亚及加勒比地区项目的供资来源；
- (b) 对于全球冷风机项目，建议进行碳融资；
- (c) 向巴西的项目推荐来自电力服务公司的资金；
- (d) 向古巴的项目推荐来自加拿大国际开发计划署（加开发计划署）的供资；
- (e) 与工发组织合作的法国全球环境基金；
- (f) 来自执行机构内部的资金供资（例如，为加勒比和古巴提供的开发计划署内部资金）；
- (g) 德国技术合作署为毛里求斯政府冷风机替换提供的供资。

52. 一系列试点计划和示范项目得到了多边基金的供资，以展示带来节能的技术可行性和经济可行性，从而向多边基金调动外部资源复制试点项目。在早前的项目中，对冷风机替换使用了多种供资模式。与全环基金共同筹资的泰国冷风机项目，与当地金融机构共同筹资的墨西哥冷风机项目，以及作为氟氯化碳国家淘汰计划一部分的土耳其冷风机替换项目获得了大量的经验，这些经验主要是关于多边基金如何与其他金融机构合作，所遇到的障碍，以及如何解决，如何在任务规定中互为补充，以及不同组织的运作程序和行政安排如何影响调动共同筹资取得成功、其费用和时机等。其中一些机构是多边性质的，例如全环基金，而其他机构是私营机构，有着不同的筹资标准和办法。

53. 能源服务公司（ESCO）是为他们客户提高能效供资的非常好的来源，因为专门机制事先不支付资金。但是，能源服务公司办法在任何国家都依赖两个要素：法治和获得供资。为保护能源服务公司免于面临其认为的向项目供资所出现的风险，必须有稳定的法律环境。

54. 能源服务公司首先确定可能的节余，然后与所有者（其客户）签署能效表现合同。根据该合同，能源服务公司同意减少能源使用，客户同意向其支付从项目中获得的一定数量的节余。然后能源服务公司执行项目，从节余中收回其投资（以及实现一些利润），客户在合同到期后继续获得节约能源带来的好处。一个公司要成为能源服务公司，必须能够确认和执行节能项目并为其投资提供资金。筹资成分是让能源服务公司区别于承包商或能源审计员的标志。但是，在大多数情况下，能源服务公司自身在一系列大型能效项目中并没有股权投资。因此，它需要第三方筹资以实现项目。大型设备供应商可利用能源服务公司作为销售它们设备的途径，同时将风险和债务保留在这家公司的账目上，而不是在其母公司的账目上。

55. 巴西的冷风机替换项目，多年来一直在讨论能源服务公司办法。但是，迄今还没有获得有关任何执行的具体成果文件证明。

56. 在墨西哥、泰国和土耳其执行了使用小额赠款（总费用的 20%至 25%）和通过循环基金共同筹资的替换大量大型离心冷风机的项目。

57. 在墨西哥，第一阶段是通过节能资金与对等捐款在国内共同筹资。第二阶段已被作为 2005 年国家淘汰计划年度工作方案的一部分得到核准。该项目第一阶段针对墨西哥特定地区，替换墨西哥总共估计 1,500 台冷风机中的 12 台离心冷风机。第二阶段针对另外 10 台冷风机。两个阶段都还正在执行，也就是说，在供资完全耗尽之前，还会在项目中加入更多的需替换冷风机。

58. 泰国冷风机项目针对的是泰国总共估计 1,400 台冷风机中的 24 台冷风机。项目宣称的目的是试验使用循环基金的可行性。所展示的已实现的节余推动了在泰国设立类似，但更为大型的贷款方案，由国内银行和离心冷风机制造商推动，但没有多边基金的参与。世界银行已向多边基金归还部分资金，这是在一开始就设想好的。目前很难估计替换项目的最终结果是什么。根据现有资料，看来该国大部分的冷风机并没有得到替换。

59. 土耳其政府正使用来自冷风机所有者的共同筹资，以执行使用循环基金机制的冷风机替换项目。一个冷风机次级项目已被纳入氟氯化碳国家淘汰计划，建立了一个使用国家淘汰计划早期年度付款下所有可用供资中很大份额的免息循环基金。据报告，迄今已通过该项目替换了 21 家公司的 40 台冷风机。与墨西哥类似，在资金耗尽之前，将被转换的冷风机数量还未确定。目标是替换 65-80 台冷风机，尽管尚不清楚是否能够实现。

八、土耳其冷风机替换过程中取得的经验

60. 土耳其是氟氯化碳淘汰的特殊案例，因为该国在多边基金支助下，是 1992-1994 年最早在冰箱制造中将各类氟氯化碳转换为 HFC-134a 的国家之一。该国很早就执行了行业范围内的项目，并在淘汰氟氯化碳的早期阶段启动了循环基金机制。土耳其政府决定在一项加速计划下淘汰各类氟氯化碳的使用，并且在 2006 年报告了氟氯化碳零消费。

61. 关于冷风机次级方案，主要的参与方是：环境和森林部、作为综合气候变化机构一部分的国家臭氧机构、土耳其技术发展基金（TTGV）、化学品和设备供应商、维修技术人员、中小工业发展组织（KOSGEB）和海关官员。土耳其决定将技术发展基金作为负责管理循环基金、受益人挑选和一般执行程序的机构。挑选的次级项目将得到世界银行的审批。

62. 据报告，在说服土耳其冷风机所有者转换他们的冷风机时遇到了一些困难，因为对必须进行高额初期投资和高额的商业利率（通常 25%-30%）及其影响存在担忧。为解决这些问题，土耳其冷风机方案（循环基金）计划以无息贷款方式提供 75%资金，以赠款方式提供 25%的资金。贷款将分为 5 次、每次间隔 6 个月偿还，在安装完成和设备启动时开始付款（利率为 0%）。这比投资市场上银行要求的利率更为优惠，因此对形势产生了很大影响。

63. 为开展一项调查，与一名顾问签署了合同，以确定冷风机数量。根据这名顾问在 2003

年春季展开的调查,他通过冷风机供应商确定了冷风机所有者。他报告称,估计总计有 1,400 台冷风机,其中 150-200 台为使用氟氯化碳的大型离心冷风机。他确定了 25 台使用 CFC-11 的冷风机, 48 台使用 CFC-12 的冷风机, 以及 8 台使用 CFC-13 或 R-500 的冷风机。

64. 2003 年 6 月分别在安塔利亚和伊斯坦布尔举行了两次有关冷风机的研讨会,其目的是提供有关冷风机替换项目的信息,并确定循环基金办法的相关条件和可能的接受能力,以及接受潜在冷风机所有者的申请。两次研讨会都有来自冷风机所有者和供应商的 21 名参与者出席。

65. 冷风机次级项目启动并使用了前期载入的多年期、基于绩效的供资以建立循环基金,根据的是与世界银行和土耳其政府(1994 年 1 月 24 日,第 21934 号)以及与世界银行和土耳其技术发展基金(1995 年 11 月 6 日,第 21942 号)签署的赠款协定。其目的是将最少的费用加在氟氯化碳淘汰方案其他组成部分上,并将循环基金并入土耳其氟氯化碳国家淘汰计划。从一开始就计划将收回的资金用于该项目完成后的剩余转换活动。

66. 就像已经指出的,土耳其执行循环基金的关键角色是土耳其技术发展基金。土耳其技术发展基金管理的特定循环基金项目周期包括以下特定项目:

- (a) 冷风机供应商让可能的受益人了解循环基金;
- (b) 审批费用,土耳其技术发展基金提供赠款部分(25%)及无息贷款部分(75%),并根据提交的发票向受益人支付;
- (c) 土耳其技术发展基金对旧冷风机和新冷风机进行衡量;
- (d) 受益人向土耳其技术发展基金支付项目总费用的 5%。

67. 关于建立资金管理模式,共签署了三份合同:世界银行与土耳其财政部副部长,世界银行和土耳其技术发展基金(金融中介)以及财政部副部长与土耳其技术发展基金。根据这三份合同,土耳其技术发展基金被指定为负责管理资金的机构,资金保存在一个特别的银行账户中。

68. 如上所述,土耳其技术发展基金从项目所有者那里获得 5%的酬金。对于土耳其技术发展基金来说,这是一项标准程序,酬金是用于支付项目监测费用,并且根据的是与受益人签署的合同。监测既包括技术监测,也包括财务监测,其中包括对偿付的管理。

69. 除建立循环基金外,看来土耳其并没有为所有冷风机淘汰拟定任何全面的战略计划。调查数据并没有提出有关公共部门与私营部门冷风机的比例的任何数据。但是,报告称,一些公共部门冷风机运营者指出,只有提供 100%的赠款,他们才会参与,因为在他们的公共部门预算中缺乏升级冷风机的资金。

70. 第一轮冷风机替换于 2003 年结束,当时仅确定了大约 39 台冷风机。后来进行了一

次调查，确定了更多使用氟氯化碳的冷风机。随后为该项目挑出了 50 个公司中大约 65-80 台冷风机，但是在项目结束时，项目仅推动了替换 21 家公司中的 40 台冷风机。

71. 对于第二轮冷风机替换，挑选标准仅包括：

- (a) 使用涡轮/离心压缩机的使用氟氯化碳的冷风机符合资助条件，因为节能潜力与这些压缩机得到改进的设计有关；
- (b) 正在运转的冷风机才符合财政资助的条件(没有运转的冷风机不能得到财政支助)。

72. 关于冷风机功效，认为项目的主要目标是应用能确保节能的技术解决方案。因此，高效解决方案被给予优先地位。对于拥有每年持续不变负荷分布的冷风机，仅对使用系数进行评估，而对于仅是季节性负荷分布的冷风机，将对使用系数和非标准部分负荷值（NPLV）进行评估。

73. 土耳其技术发展基金指出，冷风机最初清单包括 64 个公司/机构，其中 15 个既不是公共机构，也不是公共公司。在推广阶段，与这 15 个机构签订了合约，尽管尽了全力，但仍然不可能说服获得认可的人参与。

74. 土耳其技术发展基金还进一步指出，冷风机项目预算为 400 万美元，但该组织非常清楚，仅有有限数量的冷风机可被替换。土耳其技术发展基金决定，能够了解情况并迅速采取措施的私营部门受益人可获得资助资格（首选受益人）。该组织还指出，如果在第二阶段将具体重点放在公共冷风机上，或许将需要特别简化的公共受益人采购程序。此外，土耳其技术发展基金、环境和森林部和会见的个人不能就替换是否会在项目之外发生，以及如果发生，是否会很简单的解决等方面问题提供深刻的见解，因为他们不了解循环基金。

75. 在土耳其，冷风机转换没有一个明确的战略，获得的印象是冷风机无论如何都会被所有者替换。因此，提供的赠款可能不是主要的驱动因素。就循环基金来说，大多数替换都是在工作范围之外完成的，即，冷风机替换是与完全更新辅助设备一道完成的，这造成了更高的资本要求，但是对于偿还贷款，困难只会很小，或实际上不会遇到困难，因为采用的利率为 0%。

76. 冷风机循环基金项目于 2008 年 12 月 31 日完成（财务问题是在 2009 年 4 月 1 日），其结果是替换了 21 家公司中的 40 台冷风机。现在有来自基金的 250 万美元，环境和森林部还没有决定如何以最佳方式支付。因此，进度相对良好，但是很难判断该项目是否会最后会“完全”替换。

九、前南斯拉夫的马其顿共和国冷风机替换经验

77. 前南斯拉夫的马其顿共和国冷风机项目是工发组织支助的示范项目的一部分，其目的是通过在东欧和中亚网络 5 个国家替换 12 台使用氟氯化碳离心冷风机，淘汰 28 ODP 吨的各类氟氯化碳。

78. 共计 23 台使用氟氯化碳离心冷风机被确定，这至少是该国冷风机总数中的 95%。这 23 台冷风机仅位于 7 家企业。这些冷风机主要都是在政府拥有所有权的建筑物和公司内，现在已经失去了它们的市场（它们的市场是前苏维埃社会主义共和国），因此都被闲置。当前的数据表明，23 台冷风机中仅有 5 台在使用，其中 2 台已通过多边基金项目予以替换。

79. 总的来说，前南斯拉夫的马其顿共和国所有类型的冷风机，特别是离心式的，获得的维护质量很低，据称缺乏避免泄漏的预防措施。在购买冷风机时，仅有少数人得到了设备供应公司的培训，即，约在 25 至 35 年前。因此，现在的职员并不精通正确的维护和维修。

80. 同样，据称许多所有者，并没有为定期维护、配件和及时维修留出资金，以“节省资金”。据称许多所有者感到，邀请专门维修离心冷风机的公司进行维修过于昂贵。因此，许多冷风机的运行状况很差，使用系数很低，频繁发生故障，并且泄漏率很高（高达 100%）。

81. 总的来说，多边基金支助包括项目总费用的大约 60%（或者不到 60%）。受益人分摊费用各不相同，这取决于泵和/或水冷系统是否需要替换，以及是否需要建筑物进行改造以放置新的冷风机。

82. 有趣的是，前南斯拉夫的马其顿共和国的主要驱动因素（正如受益人在接受访谈时所报告的）是严重的泄漏率和相关维护费用，外加获得各类氟氯化碳的日益困难造成对未使用的担忧。受益人报告称，不管多边基金是否供资，他们都会替换冷风机；在受益人从设备供应商那里获悉多边基金可能提供赠款时，其实已经启动了替换计划。报告称多边基金提供的赠款是偶然因素，但不是主要驱动因素。

83. 在此过程中出现了拖延，主要是因为与承包人之间出现的问题，这涉及改造建筑物以放置新的冷风机。

84. 关于项目供资机制，据称工发组织考虑了循环基金的可能性，但由于淘汰日期之间没有足够剩余时间考虑任何的资金转期。

85. 关于供资选择，据称臭氧机构联系了挑选出的项目场所所有者，以获得他们对共同筹资的承诺。据称还讨论了共同筹资比例，并就用于购买设备的多边基金支助达成了协议，受益人分摊款项为所有其他基础设施费用和相关费用。工发组织逐个协商了多边基金支助水平和受益人分摊款项，并将整个项目 60%比 40%的计划目标牢记在心。

86. 来自多边基金的供资最终包括了替换冷风机的所有购买费用，而所有其他费用由受

益人承担。对于受益人承担的基础设施费用（水管、泵、建筑物改造等），各个实例之间有着显著区别，至少在一个实例中，比冷风机替换费用高出数倍。

87. 在替换 2 台冷风机后，将涉及所有余下的使用氟氯化碳冷风机的淘汰战略计划还正在完成过程中。很难估计何时完成。

十、主要评论

88. 第 5 条国家使用氟氯化碳离心冷风机的替换问题，现在已被讨论了相当长一段时间，已经确定了遇到的障碍，提出并批准了替换中采用的工作计划。但是，仍然出现了许多拖延，这提出了在第 5 条国家淘汰氟氯化碳后如何推动及将走向何处的问题。

89. 由于新冷风机比旧冷风机更有效率，电力节省以及相关财政节余非常可观。但是，这些节余将取决于国家的电力价格战略，特别是冷风机每年的运转时间比例。

90. 已经核准了许多示范替换项目；但是，项目的完成出现了拖延，多个项目不能充分完成。

91. 清洁发展机制下的项目——或是类似手段自愿碳标准下的项目——可以执行，但会带来高昂的交易成本。如果根据一项活动方案实现了大量单个项目，这才具有可行性。与赠款或赠款/贷款体系相比，通过核证减排量偿还对于单个冷风机而言将更加麻烦，并且对许多冷风机所有者并不具有吸引力。这将需要一种国内的财政中介，但会使资金体系变得复杂。

92. 循环基金从可以在 20 年内偿还的相对较少的赠款和贷款着手，其获得的经验已经部分成功。但是，如果总结从所有循环基金中获取的经验，不能得出为什么某些循环基金会比其他循环基金更为成功。在循环基金运转的国家，不是所有的冷风机所有者都被此类安排的成功模式所说服。看来在一个国家不可能使用一个循环基金替换所有使用氟氯化碳离心冷风机，即使这个循环基金的体系非常灵活，并且在公共关系和推广活动上做出了巨大的努力。

93. 尽管认为许多使用氟氯化碳离心冷风机仍在许多第 5 条国家运转，但即使在经过多年替换后，估计这个数量仍然很庞大，许多问题仍然并不清楚：

- (a) 所有这些冷风机中，其中哪一部分仍然需要替换；
- (b) 在没有金融工具介入的情况下，全球有多少冷风机已被改型或替换；
- (c) 有多少使用氟氯化碳的冷风机已不再运转；
- (d) 有多少冷风机每年运转时间的比例较小，在这种情况下，其短期财政节余将大大小于全年大部分时间满负荷运转的离心机的财政节余。

94. 后者很可能已经成为、并很可能继续是造成使用氟氯化碳离心冷风机的所有者进行转换或不进行转换的非常重要的理由。对于运转时间比例相对较低的情况，2-3 年相对较短时期内的财政结余将相对较少，远远少于偿还购买新离心冷风机外加必要辅助设备总投资额 60%-80% 的贷款。很可能这个问题是造成许多冷风机所有者不愿同意替换离心冷风机的重要理由。使用一些更小型的非离心（螺杆和涡旋压缩机驱动的）装置替换离心冷风机，本可以成为一种更具吸引力的选择（即使在某些情况下使用氨），但有关这个特定问题的技术资料难度太大，要不就是难以找到。

95. 关于第 5 条国家氟氯化碳淘汰办法，还值得注意的是，由于使用氟氯化碳离心冷风机中仍然在消费氟氯化碳，因此各国并没有报告在整个淘汰进程中遇到的困难。问题是，国家淘汰计划或结束性淘汰管理计划下，是否已经包括了一部分确实存在问题的少数离心机，或是否认为这些离心机的问题已经解决。

96. 来自诸如前南斯拉夫的马其顿共和国这样的国家的经验很有说明性，在这些地方，拟通过赠款-贷款体系替换离心机。但是在这种情况下，由于高额的维修费用和这些旧离心机技术性故障造成很长的间歇时期，以及减少各类用于维修的氟氯化碳的供应，冷风机所有者无论如何都会进行替换。

十一、结论

97. 作为首个初步结论，可提及的是，如果双边或执行机构能够为清洁发展机制或自愿碳标准确定离心冷风机项目，他们无疑会继续探索这条途径。但是，如果在以后将发放正规的核证减排量（CER）信用（这需要事先得到来自政府或其他实体为说服冷风机所有者替换设备所做的担保），就会出现管理上的缺陷，而且会减少吸引力。

98. 其次，除非第 5 条国家提供令人信服的证据，表明挑选出的仍在运转的冷风机清单（包括它们的运转历史）可以证明此类机制的效力，否则很难寻求多边基金介入或其他金融实体为替换使用氟氯化碳的冷风机提供循环基金赠款，这看来也是合理的。鉴于本研究中提及的所有限制和拖延情况，这是不可能做到的。

99. 第三，也许值得考虑的是，第 5 条国家可采用何种方式在 2010 年淘汰后实现必要的替换，或许是通过赠款以及可适应将来国家气候变化缓解行动的短期和长期贷款。一个提供国家气候奖励的体系和其他类似机制或制度性安排，或许会产生某些积极的影响。

100. 在将来某个时候，回顾第 5 条国家离心冷风机的状况，盘点旧冷风机和新的冷风机，以及在过去十年使用和未使用的、来自专用基金的财政支助所开展的所有替换活动，这可能是非常有用的。这是否可通过问卷形式实现值得怀疑，因为将很难确定调查问卷的目标群体。但是，应对项目完成情况做出正确评价，以提供有关所取得成就的总体看法。

101. 随着第 5 条国家开始淘汰氟氯烃，相应的问题开始出现，即是否应考虑替换使用 HCFC-22 的冷风机设备（这种设备容量比使用氟氯烃或氟氯化碳的离心机更小），以及以

何种方式从技术上解决这个问题。如果在此阶段不针对各种具体的解决方案，可提及的是，未来设备还将而且应保持运转多年。由于在非第 5 条国家也将以同样方式处理技术性解决方案，因此可得出结论，第 5 条国家和非第 5 条国家应齐头并进，因为类似的问题会在将来出现。

102. 任何淘汰使用 HCFC-22 的冷风机的活动，应回避需要替换、或曾经需要替换的使用氟氯化碳离心冷风机所出现的复杂问题。事实上，使用氟氯化碳离心冷风机的问题在《蒙特利尔议定书》范围内有其独特性，这并没有促成进一步的透明。起初，看来最好方式可能是将 HCFC-22 冷风机作为国家氟氯烃淘汰进程的组成部分，在这种情况下，氟氯烃淘汰管理计划应详尽阐述各类设备的转换，同时设定明确的目标。

103. 共同筹资证明不是非常有效，特别是关于离心冷风机领域。期望将来共同筹资会在广泛的活动中出现。看来通过示范项目研究这种共同筹资在所难免，例如关于销毁消耗臭氧层物质。在这样的情况下，执行机构与第 5 条国家之间的合作条件应明确限定，并定期严格评价。

104. 鉴于不同国家冷风机替换项目所取得的成果，可以得出结论，在某些情况下，第 5 条国家政府举措和控制有助于执行项目，然而在其他情况下，政府举措甚至产生不良后果。根据获得的经验，对于完全供资或共同供资的行动（例如使用氟氯化碳的冷风机替换）没有直接的建议。期望这也适用于其他多边基金资助的行动，在这些地方，共同供资应该而且可以发挥重要的作用。

十二、取得的经验

105. 使用氟氯化碳离心冷风机通常是由使用替代品的离心冷风机替换，尽管与离心冷风机相比，其技术本会更为合适，因此成为更好的选择。因而，执行机构或其技术专家在选择替换技术之前，应彻底评价所有技术选项。其他选择，例如螺杆冷风机，在某些情况下，可能比使用同类技术替换更为经济和生态。

106. 有人指出，执行机构在出现拖延和遇到冷风机所有者不合作态度后，并没有收集和转交有关为何出现这种态度的资料。这些资料本应向各机构以及多边基金提供重要的见解，本应该有助于拟定得到改进的项目方法。

107. 在某种程度上，替换使用氟氯化碳离心冷风机取得了成功。这主要是因为，在一些第 5 条国家，维修和供应商组织、金融机构和其他实体参与了帮助确定符合资助条件的设备，并提供低息贷款。但是，在这点上很难推荐任何的体系模式，因为在一些第 5 条国家，这样一个框架是实际资产，而在其他第 5 条国家，看来并没有促成任何实际的进展（例如，在巴西，鉴于多年来没有报告执行成果，可能能源服务公司的参与证明根本没有效果）。

108. 本案头文件以及国家个案研究中对取得的经验教训的全面说明，见附件五。

十三、建议

109. 谨建议执行委员会：

- (a) 注意到 UNEP/OzL.Pro/ExCom/58/9 号文件所载有关评价冷风机项目的案头文件；
- (b) 敦促双边和执行机构使用共同筹资模式，加快执行当前冷风机项目，并根据第 47/26 (f) 号决定要求，向执行委员会第五十九次会议提供进度报告；
- (c) 请高级监测与评价干事在将来某个时候，可能在 2011 年，在评价工作方案内审议包括已完成冷风机项目的最终评价，以提供对所取得成就的总体看法；
- (d) 鼓励双边和执行机构继续努力，探讨碳市场工具的适用性，例如清洁发展机制或自愿碳标准，以替换氟氯烃设备，特别是冷风机设备；
- (e) 建议双边和执行机构，对于他们可能开展的任何与冷风机转换有关的项目，应当完成对与替换有关的技术、经济、共同筹资和环境问题的彻底分析，在提交核准申请之前，应展示经济可行性和长期可持续性。根据第 47/26 (g) 号决定，这类项目不能得到多边基金支助。
- (f) 请高级监测与评价干事采取行动，向相关国家和执行机构传播关于评价冷风机项目案头文件中得出的结论和取得的经验。

Annex I

CHECKLIST OF EVALUATION QUESTIONS

Chiller project update

1. Does the country have an inventory/database of all CFC chillers?
2. How many chillers of the total were replaced to date and how many remain? What is the CFC phase-out achieved?
3. Which institution(s) coordinate(s) the chiller replacement (policies and funding)?

Management modality and legislation

1. What is the current and future (planned) management modality for the chiller phase-out (not just the project portion funded by the Multilateral Fund) (i.e. PMU, external consultant, NOU managed, etc.)?
2. Why was this management modality chosen and is it working well? If not, why?
3. Has a workable plan been designed and put in place for replacing all CFC chillers? Does it have a high probability of meeting the phase-out obligation schedule?
4. Were differences in approach needed and planned for the public and private sector chillers?
5. What was your country's choice for a chiller phase-out funding modality and why (i.e. revolving fund, grants and loans, etc.)?
6. Are the required regulatory provisions to enhance the CFC chiller phase-out in place? If not, what is still needed?

Project delays and implementation modalities

1. What were/are the reasons for implementation delays, barriers, impediments and plans for overcoming these? Were there unforeseen difficulties?
2. What were the implementation modalities and impacts (there have often been delays associated with co-financing requirements)?
3. What are the main reasons for public and private sector chiller operators to delay replacement?
4. To what extent and how have they been addressed and overcome?
5. Are chiller replacements occurring outside the project, i.e. chiller owners and operators are undertaking replacements on their own initiative? If so, why?

Co-funding and donor coordination

1. What were the final (actual) costs with a breakdown by equipment, installation, construction, energy efficiency and energy costs savings?
2. What were, or are, the potential co-funding sources explored and responses received?
3. What formal agreements are/were needed and concluded (why were they needed, with whom, and what is covered)?
4. What actual co-funding has been mobilized or is anticipated?
5. What were, or are, the problems associated with donor coordination in the face of different criteria, schedules and priorities?

Financing modalities

1. For the chillers that have been replaced to date, what were the actual chiller replacement costs (relative to expectations)?
2. Who paid what share?
3. What was the role (or possible future role) of energy savings in both project design and implementation?
4. What are the chiller owners' perceptions/views on the efficacy of the various funding arrangements or mechanisms (concessional loans, grants, revolving funds, etc.)?
5. How do NOUs see the role of carbon credits in facilitating replacements?

CFCs recovery and destruction

1. Were there any CFC recovered from the chiller project(s)?
2. Is there, or will there be, any monitoring of recovered CFCs?
3. Is there is a plan in place to deal with the recovered CFCs? (Re-use or destruction?)

Future activities

1. What is the plan for any remaining conversions?
2. Will declining CFC supplies result in replacing the remaining CFC chillers without Multilateral Fund grants?
3. Is a dual or tri-support system (Multilateral Fund, GEF and carbon financing) workable?
4. Are energy savings now a sufficient driver to cause replacements?
5. What are the lessons learned that may contribute to future policy development?

Annex II
CHILLER OVERVIEW OF APPROVED PROJECTS

Country	Code	Agency	Status*	Subsector	Project Title	ExCom Provision	ExCom Provision (Continued)	ODP To Be Phased Out	ODP Phased Out*	Date Approved	Approved Planned Date of Completion	Date Completed *	Planned Date of Completion for Ongoing Projects*	Funds Approved	Funds Returned	Funds Disbursed*
Chiller funding window: projects approved at the 47th Meeting or later																
Region: AFR	AFR/REF/48/DEM/34	Germany	ONG	Chiller	Strategic demonstration project for accelerated conversion of CFC chillers in 5 African countries (Cameroon, Egypt, Namibia, Nigeria and Sudan)	Approved on the understanding that external resources of US \$477,876 for the whole project were to be used only for activities considered to be part of the project costs; disbursement of the amounts approved would be dependent upon the availability of external resources as specified, to be confirmed by the Secretariat, based on the advice from the agency that external funding had been secured. The ratio between the maximum amount of the fund resources that could be disbursed and the external resources confirmed by the Secretariat should be equal to the ratio between the amount approved and the corresponding amount of associated external resources; additional countries in Africa could receive support for phase-out in the chiller sector under the project, provided that funding under the project was available, and that all other conditions established by the Executive Committee in its respective decisions regarding chiller demonstration projects were being met.	UNIDO and the bilateral agencies involved would inform the Secretariat on an annual basis, and in time for the last Meeting of the Executive Committee, in every year of project implementation as well as in the year of completion, on progress in terms of implementation, main experiences and additional external resources acquired for the chiller phase-out and major market transformations observed.	0,0		Apr-06	Sep-09		Sep-09	192.500	0	93.739
Region: AFR	AFR/REF/48/DEM/35	Japan	ONG	Chiller	Strategic demonstration project for accelerated conversion of CFC chillers in 5 African countries (Cameroon, Egypt, Namibia, Nigeria and Sudan)	Approved on the understanding that external resources of US \$477,876 for the whole project were to be used only for activities considered to be part of the project costs; disbursement of the amounts approved would be dependent upon the availability of external resources as specified, to be confirmed by the Secretariat, based on the advice from the agency that external funding had been secured. The ratio between the maximum amount of the fund resources that could be disbursed and the external resources confirmed by the Secretariat should be equal to the ratio between the amount approved and the corresponding amount of associated external resources; additional countries in Africa could receive support for phase-out in the chiller sector under the project, provided that funding under the project was available, and that all other conditions established by the Executive Committee in its respective decisions regarding chiller demonstration projects were being met.	UNIDO and the bilateral agencies involved would inform the Secretariat on an annual basis, and in time for the last Meeting of the Executive Committee, in every year of project implementation as well as in the year of completion, on progress in terms of implementation, main experiences and additional external resources acquired for the chiller phase-out and major market transformations observed.	0,0		Apr-06	Sep-09		Sep-09	700.000	0	
Region: AFR	AFR/REF/48/DEM/36	France	ONG	Chiller	Strategic demonstration project for accelerated conversion of CFC chillers in 5 African countries (Cameroon, Egypt, Namibia, Nigeria and Sudan)	Approved on the understanding that external resources of US \$477,876 for the whole project were to be used only for activities considered to be part of the project costs; disbursement of the amounts approved would be dependent upon the availability of external resources as specified, to be confirmed by the Secretariat, based on the advice from the agency that external funding had been secured. The ratio between the maximum amount of the fund resources that could be disbursed and the external resources confirmed by the Secretariat should be equal to the ratio between the amount approved and the corresponding amount of associated external resources; additional countries in Africa could receive support for phase-out in the chiller sector under the project, provided that funding under the project was available, and that all other conditions established by the Executive Committee in its respective decisions regarding chiller demonstration projects were being met.	UNIDO and the bilateral agencies involved would inform the Secretariat on an annual basis, and in time for the last Meeting of the Executive Committee, in every year of project implementation as well as in the year of completion, on progress in terms of implementation, main experiences and additional external resources acquired for the chiller phase-out and major market transformations observed.	0,0		Apr-06	Sep-09		Sep-09	360.000	0	0

*According to the 2007 Progress Reports.
As of 3 July 2008

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CHILLER OVERVIEW OF APPROVED PROJECTS

Country	Code	Agency	Status*	Subsector	Project Title	ExCom Provision	ExCom Provision (Continued)	ODP To Be Phased Out	ODP Phased Out*	Date Approved	Approved Planned Date of Completion	Date Completed *	Planned Date of Completion for Ongoing Projects*	Funds Approved	Funds Returned	Funds Disbursed*
Region: AFR	AFR/REF/48/DEM/37	UNIDO	ONG	Chiller	Strategic demonstration project for accelerated conversion of CFC chillers in 5 African countries (Cameroon, Egypt, Namibia, Nigeria and Sudan)	Approved on the understanding that external resources of US \$477,876 for the whole project were to be used only for activities considered to be part of the project costs; disbursement of the amounts approved would be dependent upon the availability of external resources as specified, to be confirmed by the Secretariat, based on the advice from the agency that external funding had been secured. The ratio between the maximum amount of the fund resources that could be disbursed and the external resources confirmed by the Secretariat should be equal to the ratio between the amount approved and the corresponding amount of associated external resources; additional countries in Africa could receive support for phase-out in the chiller sector under the project, provided that funding under the project was available, and that all other conditions established by the Executive Committee in its respective decisions regarding chiller demonstration projects were being met.	UNIDO and the bilateral agencies involved would inform the Secretariat on an annual basis, and in time for the last Meeting of the Executive Committee, in every year of project implementation as well as in the year of completion, on progress in terms of implementation, main experiences and additional external resources acquired for the chiller phase-out and major market transformations observed.	0,0	0,0	Apr-06	Sep-09		Sep-09	747.500	0	26.521
Brazil	BRA/REF/47/DEM/275	UNDP	ONG	Chiller	Demonstration project for integrated management of the centrifugal chiller sub-sector, focusing on application of energy-efficient CFC-free technologies for replacement of CFC-based chillers	Approved funding, with external resources of US \$252,000 to replace at least 12 chillers in the country (the external resources associated were to be used only for activities considered to be part of the project costs). Disbursement of the amounts approved was dependent upon the availability of external resources to be confirmed by the Secretariat based on the advice from the agency that external funding had been secured. The ratio between the maximum amount of the fund resources that could be disbursed and the external resources confirmed by the Secretariat should be equal to the ratio between the amount approved and the corresponding amount of associated external resources.	The agency was requested to inform the Secretariat on an annual basis, in time for the last Meeting of the Committee in every year of project implementation, as well as in the year of completion, on progress in terms of implementation, main experiences and additional external resources acquired for the chiller phase-out and major market transformations observed.	0,0	0,0	Nov-05	Dec-08		Dec-09	1.000.000	0	0
Colombia	COL/REF/47/DEM/65	UNDP	ONG	Chiller	Demonstration project for integrated management of the centrifugal chiller sub-sector, focusing on application of energy-efficient CFC-free technologies for replacement of CFC-based chillers	Approved funding, with external resources of US \$705,000 to replace at least 13 chillers in the country (the external resources associated were to be used only for activities considered to be part of the project costs). Disbursement of the amounts approved was dependent upon the availability of external resources to be confirmed by the Secretariat based on the advice from the agency that external funding had been secured. The ratio between the maximum amount of the fund resources that could be disbursed and the external resources confirmed by the Secretariat should be equal to the ratio between the amount approved and the corresponding amount of associated external resources.	The agency was requested to inform the Secretariat on an annual basis, in time for the last Meeting of the Committee in every year of project implementation, as well as in the year of completion, on progress in terms of implementation, main experiences and additional external resources acquired for the chiller phase-out and major market transformations observed.	0,0	0,0	Nov-05	Dec-08		Jan-10	1.000.000	0	0

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As of 3 July 2008

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CHILLER OVERVIEW OF APPROVED PROJECTS

Country	Code	Agency	Status*	Subsector	Project Title	ExCom Provision	ExCom Provision (Continued)	ODP To Be Phased Out	ODP Phased Out*	Date Approved	Approved Planned Date of Completion	Date Completed *	Planned Date of Completion for Ongoing Projects*	Funds Approved	Funds Returned	Funds Disbursed*
Cuba	CUB/REF/47/DEM/35	Canada	TRF	Chiller	Demonstration project for integrated management of the centrifugal chiller sub-sector, focusing on application of energy-efficient CFC-free technologies for replacement of CFC-based chillers	Approved funding, with external resources of US \$410,125 to replace at least 7 chillers in the country and to convert a further 5 chillers (the external resources associated were to be used only for activities considered to be part of the project costs). Disbursement of the amounts approved was dependent upon the availability of external resources to be confirmed by the Secretariat based on the advice from the agency that external funding had been secured. The ratio between the maximum amount of the fund resources that could be disbursed and the external resources confirmed by the Secretariat should be equal to the ratio between the amount approved and the corresponding amount of associated external resources.	The agency was requested to inform the Secretariat on an annual basis, in time for the last Meeting of the Committee in every year of project implementation, as well as in the year of completion, on progress in terms of implementation, main experiences and additional external resources acquired for the chiller phase-out and major market transformations observed. Note: At its 51st Meeting, the Executive Committee noted that the project was transferred to UNDP.	0,0		Nov-05	Dec-08			196.871	-196.871	0
Cuba	CUB/REF/47/DEM/36	UNDP	ONG	Chiller	Demonstration project for integrated management of the centrifugal chiller sub-sector, focusing on application of energy-efficient CFC-free technologies for replacement of CFC-based chillers	Approved funding, with external resources of US \$410,125 to replace at least 7 chillers in the country and to convert a further 5 chillers (the external resources associated were to be used only for activities considered to be part of the project costs). Disbursement of the amounts approved was dependent upon the availability of external resources to be confirmed by the Secretariat based on the advice from the agency that external funding had been secured. The ratio between the maximum amount of the fund resources that could be disbursed and the external resources confirmed by the Secretariat should be equal to the ratio between the amount approved and the corresponding amount of associated external resources.	The agency was requested to inform the Secretariat on an annual basis, in time for the last Meeting of the Committee in every year of project implementation, as well as in the year of completion, on progress in terms of implementation, main experiences and additional external resources acquired for the chiller phase-out and major market transformations observed. Note: At its 51st Meeting, the Executive Committee noted that the project was transferred from the Government of Canada to UNDP.	0,0	0,0	Nov-05	Dec-08		Mar-09	787.482	196.871	0
Region: EUR	EUR/REF/47/DEM/06	UNIDO	ONG	Chiller	Demonstration project on the replacement of CFC centrifugal chillers in Croatia, the former Yugoslav Republic of Macedonia, Montenegro, Romania, and Serbia	Approved funding, with external resources of US \$416,175 to replace at least 12 chillers in the region (the external resources associated were to be used only for activities considered to be part of the project costs). Disbursement of the amounts approved was dependent upon the availability of external resources to be confirmed by the Secretariat based on the advice from the agency that external funding had been secured. The ratio between the maximum amount of the fund resources that could be disbursed and the external resources confirmed by the Secretariat should be equal to the ratio between the amount approved and the corresponding amount of associated external resources.	The agency was requested to inform the Secretariat on an annual basis, in time for the last Meeting of the Committee in every year of project implementation, as well as in the year of completion, on progress in terms of implementation, main experiences and additional external resources acquired for the chiller phase-out and major market transformations observed.	0,0	0,0	Nov-05	Dec-08		Dec-08	1.069.074	0	114.627
Global	GLO/REF/47/DEM/268	IBRD	ONG	Chiller	Global chiller replacement project (China, India, Indonesia, Malaysia and Philippines)	Approved under the condition that implementation of the programme would include activities in China, India, Indonesia, Jordan, Malaysia, Philippines and Tunisia, with external resources of US \$13,769,224 to replace at least 150 chillers (the external resources associated were to be used only for activities considered to be part of the project costs). Disbursement of the amounts approved was dependent upon the availability of external resources to be confirmed by the Secretariat based on the advice from the agency that external funding had been secured. The ratio between the maximum amount of the fund resources that could be disbursed and the external resources confirmed by the Secretariat should be equal to the ratio between the amount approved and the corresponding amount of associated external resources.	The agency was requested to inform the Secretariat on an annual basis, in time for the last Meeting of the Committee in every year of project implementation, as well as in the year of completion, on progress in terms of implementation, main experiences and additional external resources acquired for the chiller phase-out and major market transformations observed.	0,0	0,0	Nov-05	Dec-13		Dec-13	6.884.612	0	0

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Annex II
CHILLER OVERVIEW OF APPROVED PROJECTS

Country	Code	Agency	Status*	Subsector	Project Title	ExCom Provision	ExCom Provision (Continued)	ODP To Be Phased Out	ODP Phased Out*	Date Approved	Approved Planned Date of Completion	Date Completed *	Planned Date of Completion for Ongoing Projects*	Funds Approved	Funds Returned	Funds Disbursed*
Global	GLO/REF/48/TAS/275	UNEP	ONG	Chiller	Global technical assistance programme in the chiller sector			0,0	0,0	Apr-06	Apr-09		Apr-09	200.000	0	0
Region: LAC	LAC/REF/47/DEM/36	UNDP	ONG	Chiller	Demonstration project for integrated management of the centrifugal chiller sub-sector in the Caribbean, focusing on application of energy-efficient CFC-free technologies for replacement of CFC-based chillers	Approved funding, with external resources of US \$690,000 to replace at least 14 chillers in the region (the external resources associated were to be used only for activities considered to be part of the project costs). Disbursement of the amounts approved was dependent upon the availability of external resources to be confirmed by the Secretariat based on the advice from the agency that external funding had been secured. The ratio between the maximum amount of the fund resources that could be disbursed and the external resources confirmed by the Secretariat should be equal to the ratio between the amount approved and the corresponding amount of associated external resources.	The agency was requested to inform the Secretariat on an annual basis, in time for the last Meeting of the Committee in every year of project implementation, as well as in the year of completion, on progress in terms of implementation, main experiences and additional external resources acquired for the chiller phase-out and major market transformations observed.	0,0	0,0	Nov-05	Dec-08		Jun-09	1.000.000	0	0
Syrian Arab Republic	SYR/REF/47/DEM/93	UNIDO	ONG	Chiller	Demonstration project on the replacement of CFC centrifugal chillers	Approved funding, with external resources of US \$27,195 to replace at least 3 chillers in the country and to convert a further 4 chillers (the external resources associated were to be used only for activities considered to be part of the project costs). Disbursement of the amounts approved was dependent upon the availability of external resources to be confirmed by the Secretariat based on the advice from the agency that external funding had been secured. The ratio between the maximum amount of the fund resources that could be disbursed and the external resources confirmed by the Secretariat should be equal to the ratio between the amount approved and the corresponding amount of associated external resources.	The agency was requested to inform the Secretariat on an annual basis, in time for the last Meeting of the Committee in every year of project implementation, as well as in the year of completion, on progress in terms of implementation, main experiences and additional external resources acquired for the chiller phase-out and major market transformations observed.	0,0	0,0	Nov-05	Dec-08		Dec-08	585.961	0	-107.309
Early chiller investment, technical assistance and training projects																
China	CPR/REF/06/TRA/05	UNDP	FIN	Training programme/workshop	Establishment of a training programme for centrifugal chillers and domestic refrigeration service managers and technicians			0,0	0,0	Feb-92	Sep-93	Sep-93		75.000	0	75.000
India	IND/REF/10/1/NV/08	IBRD	FIN	Chiller	Substitution of CFC-11 refrigerant by HCFC-123 in centrifugal chillers (Blue Star)			36,0	36,0	Jun-93	Jun-96	Dec-97		567.000	-146.504	420.496
Côte d'Ivoire	IVC/REF/37/1/NV/17	France	TRF	Chiller	ODS phase out in 50 existing centrifugal chillers units	Approved on the understanding that the project, having a significant cost-share component and, being a demonstration project for the African region, would complete the cycle of demonstration projects in the chiller sub-sector for each region, and that no further chiller demonstration projects would be		18,0		Jul-02	Aug-06		Dec-07	1.000.000	0	0
Lebanon	LEB/REF/28/	France	COM	Technical	Remaining issues for a RMP			0,0		Jul-99	Feb-02	Aug-01		45.750	0	24.784
Lebanon	LEB/REF/28/TAS/31	Germany	FIN	Technical assistance/support	Remaining issues for a RMP and preparation of strategy and projects for reduction of CFC emissions in centrifugal chillers			0,0	0,0	Jul-99	Feb-02	Nov-01		37.550	-3	37.547
Malaysia	MAL/REF/18/TAS/77	IBRD	FIN	Recovery/recycling	Reduction of the consumption of ODSs in the commercial air conditioning sector via training, recovery and recycling of CFC-11 and CFC-12 in chillers at Mashrae			105,0	4,5	Nov-95	Nov-96	Nov-00		824.078	-118.061	706.017

*According to the 2007 Progress Reports.
As of 3 July 2008

Annex II
CHILLER OVERVIEW OF APPROVED PROJECTS

Country	Code	Agency	Status*	Subsector	Project Title	ExCom Provision	ExCom Provision (Continued)	ODP To Be Phased Out	ODP Phased Out*	Date Approved	Approved Planned Date of Completion	Date Completed *	Planned Date of Completion for Ongoing Projects*	Funds Approved	Funds Returned	Funds Disbursed*
Mexico	MEX/REF/08/TRA/19	USA	FIN	Training programme/workshop	Chiller hands-on training			0,0		Oct-92	Oct-93	Oct-93		340.000	0	340.000
Mexico	MEX/REF/13/TRA/25	USA	FIN	Training programme/workshop	Cancun chiller workshop			0,0		Jul-94	Jul-95	Jul-95		9.000	0	9.000
Mexico	MEX/REF/28/INV/95	UK	FIN	Chiller	Chiller concessional lending pilot project	The Multilateral Fund money repaid in the first phase of the project would be made available for redeployment by the Executive Committee within three years of project approval and would be usable, based on a decision to be taken by the Executive Committee, either for a second phase of chiller purchases in Mexico or for other specific ODS phase-out projects in that country.		5,0	7,8	Jul-99	Feb-04	Mar-04		565.000	0	565.000
Syrian Arab Republic	SYR/REF/29/INV/56	France	COM	Chiller	CFC emission reduction in central air conditioning			0,9		Nov-99	Jun-02	Dec-06		143.000	0	106.383
Thailand	THA/REF/26/INV/104	IBRD	FIN	Chiller	Programme to reduce the usage of CFC-11 and CFC-12 in chiller servicing by replacing CFC-based chillers with HFC-134a and HCFC-123 chillers at Electricity Generating Authority (EGAT)	Approved on the understanding that the project did not constitute a precedent and that its approval was without prejudice to the ongoing discussions on the question of concessional lending. The World Bank was requested to provide an annual update on the status of the project and to draw lessons learned based on the following information: (i) whether actual savings were equal or greater than originally anticipated; and (ii) whether CFCs from old chillers were properly recovered, recycled and reused in servicing remaining chillers.		13,2	13,2	Nov-98	Dec-02	Sep-03		2.475.000	-1.276.053	0
Venezuela (Bolivarian Republic of)	VEN/REF/08/INV/08	IBRD	CLO	Chiller	Replacement of CFC by HFC-134a as a refrigerant in central air conditioning units at Instituto Venezolano de los Seguros Sociales			0,0	0,0	Oct-92	Apr-94			851.000	-851.000	0
Venezuela (Bolivarian Republic of)	VEN/REF/08/INV/09	IBRD	FIN	Chiller	Replacement of CFC by HFC-134a as a refrigerant in central air conditioning units at Clínica Atlas, Hospitalización y Servicios			4,0	4,0	Oct-92	Apr-94	Jan-97		115.000	0	115.000
Venezuela (Bolivarian Republic of)	VEN/REF/08/INV/10	IBRD	FIN	Chiller	Replacement of CFC by HFC-134a as a refrigerant in central air conditioning units at Instituto de Prevencion Social del Médico			2,0	2,0	Oct-92	Apr-94	Sep-95		69.000	0	69.000
Venezuela (Bolivarian Republic of)	VEN/REF/08/INV/11	IBRD	CLO	Chiller	Replacement of CFC by HFC-134a as a refrigerant in central air conditioning units at Congreso de la Republica			0,0	0,0	Oct-92	Apr-94			65.000	-65.000	0
Viet Nam	VIE/REF/28/INV/22	France	FIN	Chiller	CFC emission reductions in spinning halls air conditioning systems chillers (pilot project)			3,6	3,6	Jul-99	Aug-01	Dec-02		197.340	0	197.340

*According to the 2007 Progress Reports.
As of 3 July 2008

Annex III

SUMMARY OF CHILLER PROJECTS AS COMPONENTS OF NPPs AND TPMPs

Country (project no.)	Agency	Date approved	Project title	Project description for the chiller component	Executive Committee provisions
Argentina (ARG/PHA/47/INV/148)	IBRD	Nov-05	National CFC phase-out plan: 2006 work programme	Implementation of several activities to reduce the use of CFC refrigerants in chillers. The World Bank was not foreseen as a cooperating implementing agency in the original agreement between the Government and the Executive Committee. With the reallocation of funds within the plan to accommodate a chiller component with the World Bank as its implementer, the agreement has been revised.	Approved the revised agreement between the Government and the Executive Committee including the World Bank as a cooperating implementing agency for a chiller component, as proposed by the Government.
Bahrain (BAH/PHA/50/INV/16)	UNDP Jointly implemented with UNEP.	Nov-06	Terminal phase-out management plan (first tranche)	Technical assistance project for chiller retrofit/replacement	
Brazil (BRA/PHA/47/INV/274)	UNDP	Nov-05	National CFC phase-out plan: fourth tranche	The activities proposed are related to the implementation of activities in the commercial refrigeration and chillers sub-sectors.	
Brazil (BRA/PHA/56/INV/284)	UNDP	Nov-08	National CFC phase-out plan (seventh tranche)	Five (5) recovery machines for the chiller sector	
Colombia (COL/PHA/41/INV/60)	UNDP	Dec-03	National phase-out plan for Annex A (Group I and II) substances: first implementation programme	An incentive to equipment owners to replace or retrofit the CFC-based chillers with new non-CFC refrigerant.	
Cuba (CUB/PHA/48/INV/37)	UNDP	Apr-06		To complete the implementation of the following activities: chiller containment and engineering; incentive programme for retrofit chillers and consoles.	Upon a request by the Government of Cuba, funds transferred from the balance of the two previous tranches approved for the Governments of France and Germany.
Ecuador (ECU/PHA/45/INV/36)	IBRD	Apr-05	National CFC phase-out plan: 2005 annual programme	Training in the chillers servicing sector	
Ecuador (ECU/PHA/49/INV/37)	IBRD	Jul-06	National CFC phase-out plan: 2006 annual programme	Preparation and implementation of a chiller replacement project; training in the chillers servicing sector	
Ecuador (ECU/PHA/52/INV/39)	IBRD	Jul-07	National CFC phase-out plan: 2007 annual programme	Implementation of a chiller replacement project	
Ecuador (ECU/PHA/56/INV/41)	IBRD	Nov-08	National CFC phase-out plan: 2008 annual programme	Implementation of chiller replacement and a training course on chiller maintenance and best practices conducted	Approved on the understanding that the World Bank would forward a copy of the report on the chiller replacement to the Secretariat when it became available.
Honduras (HON/PHA/55/INV/26)	UNIDO	Jul-08	Terminal phase-out management plan (first tranche)	Implementation of an incentive programme for conversion of domestic and industrial refrigeration systems and chillers	

Country (project no.)	Agency	Date approved	Project title	Project description for the chiller component	Executive Committee provisions
Jamaica (JAM/PHA/37/TAS/16)	Canada	Jul-02	Terminal phase-out management plan for CFCs: training and recovery and recycling	Additional recovery and recycling equipment and associated training for the commercial/industrial, MAC and chillers sub-sectors	
Malaysia (MAL/PHA/35/INV/145)	IBRD	Dec-01	National CFC phase-out plan: 2002 annual programme	Retirement of existing CFC-dependent equipment, including chillers and vehicles	
Malaysia (MAL/PHA/52/INV/158)	IBRD	Jul-07	National CFC phase-out plan: 2007 annual programme	Continue with the chiller replacement/retirement programme.	The World Bank and the Government were encouraged to examine closely the need for stockpiling and the functioning of the recovery and recycling programme to plan for the continued demand for CFCs beyond 2010, in view of the approaching final phase-out.
Mauritius (MAR/PHA/50/INV/18)	Germany	Nov-06	Implementation of an ODS terminal phase-out management plan (third tranche)	Finish retrofitting the chiller at New Court House.	
Mexico (MEX/PHA/45/INV/124)	IBRD	Apr-05	National CFC phase-out plan: 2005 work programme	For the second phase, five chiller owners have already been identified, and discussions are ongoing with several more. The World Bank was originally not mentioned in the agreement between the Government and the Executive Committee (at its 41st Meeting, the Committee endorsed the implementation of this activity that would be subsumed into the phase-out plan).	
Mexico (MEX/PHA/50/INV/130)	UNIDO	Nov-06	National CFC phase-out plan: 2006 work programme	Four (4) chiller replacements; continue the development of a strategy for the long-term management of refrigerants, which focuses on storage, recycling, and the feasibility of installing a destruction facility.	
Mongolia (MON/PHA/47/INV/10)	Japan	Nov-05	Terminal phase-out management plan: first tranche	Establishment of CFC stockpiles for servicing the two chillers in operation after 2010 (about 1.5 ODP tonnes of CFC-11) and other CFC-based refrigeration systems.	
Thailand (THA/PHA/35/INV/137)	IBRD	Dec-01	National CFC phase-out plan: 2002 Annual Programme	Retirement of existing CFC-dependent equipment, including chillers and vehicles	
Turkey (TUR/PHA/35/INV/75)	IBRD	Dec-01	Total phase-out of CFCs plan: 2001 and 2002 annual programmes	The chiller replacement program will be started in the second half of 2002 by inviting owners of chillers to register their chillers so that a database can be established. The information will assist the development of the more detailed plan for the chiller replacement programme, including selection criteria, standard contract form.	
Turkey (TUR/PHA/41/INV/81)	IBRD	Dec-03	Total phase-out of CFCs plan: 2004 annual programme	Sign contracts with eligible chiller companies as identified during 2003 and 2004.	

Country (project no.)	Agency	Date approved	Project title	Project description for the chiller component	Executive Committee provisions
Turkey (TUR/PHA/44/INV/85)	IBRD	Dec-04	Total phase-out of CFCs plan: 2005 annual programme	Sign contracts with eligible chiller companies as identified during 2004 and 2005.	
Turkey (TUR/PHA/47/INV/87)	IBRD	Nov-05	Total phase-out of CFCs plan: 2006 annual programme	Sign contracts with eligible chiller companies as identified since 2003.	
Turkey (TUR/PHA/50/INV/89)	IBRD	Nov-06	Total phase-out of CFCs plan: 2007 annual programme	Signature of contracts with eligible chiller companies as identified since 2003	

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Annex IV

REASONS FOR IMPLEMENTATION DELAYS

1. The reasons for implementation delays are the following:
 - (a) The East Asia financial crisis of 1998 to 2001 had significant impacts on the Thailand project. Thailand introduced restrictions or prohibitions for commercial banks to provide loans to any enterprise with any amount outstanding under a non-performing loan and the interest rates available on the market became unattractive;
 - (b) Lack of a policy driver for ensuring a transition to new chillers, from either the ODS or energy efficiency perspective. No legislation and/or regulations were in place requiring that CFC chillers be replaced or facilitating replacement by non-CFC chillers;
 - (c) In the case of Thailand, the Ministry of Energy offered several financial subsidy schemes to promote energy efficiency targeted, *inter alia*, at replacing old CFC chillers with new energy efficient non-CFC chillers. These incentives were considered by the private sector more attractive than the ones offered by the Multilateral Fund project; the interest rates were very low with longer repayment period and no requirements to dismantle the old CFC chiller and to install a data logger to the new chiller. Buying and installing data loggers, reporting, destruction of old chillers, the chiller manufacturer reports, adds around 15 per cent to the project costs;
 - (d) Difficulties were experienced in creating/activating/raising the excise tax as a disincentive to continued CFC use;
 - (e) Borrowers dropping out of the project;
 - (f) Reluctance of suppliers to participate in a programme with a complex set of requirements, namely, performance guarantees, detailed proposal submissions and bank guarantees;
 - (g) Lack of flexibility in project design;
 - (h) Submission of individual project documents for owners of multiple chillers;
 - (i) Complex project guarantee requirements. In Thailand this explains why several project owners chose to undertake additional chiller conversions without using the project window;
 - (j) No technical assistance budget available although needed;
 - (k) Special Drawing Rights (SDRs) currency problems. SDRs are potential claims on the freely usable currencies of International Monetary Fund members. SDRs are defined in terms of a basket of major currencies used in international trade and finance. At the first stage, the source of funds (GEF) would support a grant in term of SDR currency, which caused problems because it was difficult to identify the exact amount of the loan. However, this problem was solved by fixing the exchange rate at SDR1 = US \$1.27645;
 - (l) Delays in negotiating the default clause;
 - (m) New guidelines and regulations for implementing agencies were required for individual loan schemes (for example, the World Bank) as former guidelines were not applicable;

- (n) The project's limited timeframe made it difficult to find new clients;
- (o) Lack of confidence in new chiller technologies;
- (p) Unclear direction on how to scrap and/or dismantle existing chillers;
- (q) Participants doubtful due to previous unsuccessful experiences with a similar programme;
- (r) Chiller replacement was considered by some as a second priority. Hotels would invest first in convenient facilities, room decoration and renovation. It was reportedly difficult to persuade enterprises in this sector to join the programme;
- (s) Many enterprises expressed reluctance to invest as long as CFCs were still available, therefore restrictions on CFC supply are required;
- (t) Implementation delays due to an unstable political environment and problems with inter-governmental relations (Côte d'Ivoire);
- (u) Lack of inter-institutional agreements (for example, Mexico);
- (v) Delays associated with building modifications required to accommodate the replacement chillers;
- (w) Delays associated with the inadequate assignment of human resources for the chiller projects.

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Annex V

LESSONS LEARNED FROM THE CHILLER PROJECT DOCUMENTS AND THE THREE CASE STUDIES

I. Lessons learned from the document review

(a) Mechanisms and methodologies

1. Different methodologies/replacement schemes, with a high degree of flexibility, are necessary to adapt a programme to the needs in different countries where markedly different local conditions prevail.
2. Support for the replacement of existing chillers, short of funding full replacement, can be provided in a number of different ways such as rebates, loans to the owner or performance contracting where the technology provider guarantees energy efficiency.
3. National policies regarding the final phase-out of CFCs are not just awareness raising and a needed stimulus, but likely a precondition for a large number of centrifugal chiller owners to pursue replacement projects.
4. A key lesson learned in Thailand was that when field testing a new or innovative mechanism such as this project entailed, flexibility (time allocation) needs to be build into the project to take account of unforeseen barriers and impediments.

(b) Financing

5. Demonstration projects have shown that replacement of CFC chillers can successfully be funded with grants combined with loans but their overall efficacy in facilitating replication remains questionable.
6. The amount of financial support required for chiller replacement varies depending on the prevailing national conditions such as tariffs, regulations, energy costs, etc..
7. The use of two funding sources, the Multilateral Fund and the Global Environment Facility (GEF), can complicate project implementation. For example, in the Thailand project, the financial intermediaries (FI) and enterprises had to report separately on their utilization of the two funds, and the World Bank task team had to manage two budgets and report completion twice. From the Bank and the country perspectives, similar learning objectives could have been incorporated into a simpler instrument, possibly even by a technical assistance project. Efforts need to be made to merge reporting requirements.

(c) Recovery and recycling of CFCs

8. If a non-governmental organization (NGO) is utilized to implement a CFC recovery and recycle programme, it will need to prepare a business plan to maintain the facility and provide the service continuously. It will also need an assurance of continuing financial support. Any lack of response from the owners of chillers and other stakeholders will make it difficult for voluntary societies or NGOs to implement the business plan effectively. According to the information available, recovery and recycling for chillers is so far economically not sustainable. However, with rising CFC prices and rapidly declining supplies of virgin CFC this might change.
9. The success of a refrigerant recovery and recycling network depends on close cooperation between the network operator and the government authority, which enforces the relevant regulations requiring the CFC users to recover and recycle their refrigerants.

10. The nature of the recovery and recycling network facility, if using a highly sophisticated technology and electronic controls, requires a dedicated team to maintain and operate the equipment on a full time basis.

(d) Lessons learned from the Mexican chiller project

11. As per an implementing agency, the main lesson learned from the Mexican chiller project was that it is feasible to design a revolving fund that is sustainable over time and that can help speed the replacement of chillers. Other lessons learned were:

- (a) The revolving fund design is easy to implement and can be easily replicated in other countries. This mechanism can be used to efficiently replace a significant number of chillers with a relatively small budget;
- (b) Reliable procedures developed to measure and verify electricity savings are essential to guarantee that chiller producers offer the best products and stand behind them. This is especially important if energy savings are to be used to generate Certified Emission Reductions (CERs) with a view to carbon financing;
- (c) Loan conditions, both in units of investment (i.e., an inflation-adjusted monetary unit updated daily based on the consumer price index) and the US dollar, were attractive to building owners, proving that a credit programme in the sector is feasible;
- (d) CFC losses (leaks) may be much higher than anticipated. In one extreme case, in Mexico, the old chiller was supposed to contain 240 kg of CFC-11, but only 40 kg were recovered.

(e) Private sector response and economic framework

12. Effective communication is required to dispel an often high degree of initial scepticism of chiller owners, particularly during the start-up phase. Experience has shown (for example, Thailand) that once the benefits of chiller replacement become clear, the scepticism disappears. Demonstration projects thus play an important role.

13. One driving factor for chiller replacement is the increasing realization of the future declining availability of CFC supply.

14. There is significant interest from the chiller manufacturers who wish to market their replacement products. Their marketing efforts can include activities such as identifying chiller owners, awareness raising, assessing the owners' needs for replacement, and their interest, and offering other forms of support. Manufacturers of centrifugal chillers have excellent avenues for communicating with chiller owners.

15. As per the implementing agency, the Thailand project was technically well conceived, but overestimated the willingness of the participants to come forward in spite of the low interest rate that was meant to attract them. The financial attraction of the offer was also eroded by the rapidly falling interest rates since the end of 2001. Other factors included rapidly changing economic conditions such as interest rate earnings and CER prices.

16. As per the PCR document THA.REF.26.INV.104, it was noted by the financial intermediary that more time was needed to identify and appraise the enterprises. In spite of the success of the project, the formalities and requirements of the programme discouraged additional participation by enterprises. If the

programme had been made more flexible and designed with a different approach of investment (i.e., financing) results could have perhaps been better.

17. As per an implementing agency report for the Thailand chiller project, projects of this nature being implemented in a very dynamic macroeconomic environment (for example, economic recovery, falling interest rates and increase in private savings) should have a flexible design to adjust to this environment. In addition, the Thailand project needed to remain competitive in the existing policy framework, even during implementation.

18. The Government of Thailand supported simultaneously competing initiatives (energy saving programmes and the chiller project) both focused on chillers and providing financing and other programmatic requirements on markedly differing terms. This was problematic.

II. Lessons learned from the three case studies

19. From Turkey's experience it was learned that it is difficult to convince chiller owners to convert their chillers if there is a need for a very high initial investment combined with a lack of incentives for energy efficiency (if low electricity tariffs and lack of other fiscal incentives for adopting energy saving devices prevail). To overcome these problems a high proportion of funding needed to be subsidized (Turkey offered 75 per cent as an interest-free loan and 25 per cent as a grant).

20. Detailed and separate case study reports have been prepared for Turkey (Chiller Revolving Fund) and the chiller demonstration projects for Croatia and the former Yugoslav Republic of Macedonia (both are part of the UNIDO-assisted demonstration project with the aim of replacing 12 CFC-based centrifugal chillers in five countries in the Eastern Europe and Central Asia Network with new energy efficient ones. This UNIDO project was designed to facilitate the early replacement of CFC chillers with low-energy efficiency to non-CFC chillers with a high-energy efficiency. These case study reports set out in each case the relevant background, the contextual setting, the project experience, the project specific evaluation conclusions and lessons learned. These are available from the Secretariat upon request.

21. Demonstration projects are often designed to give local commercial banks, suppliers and project promoters more comfort and flexibility in implementing and financing such projects on a stand-alone basis. They are usually often designed to address concerns and uncertainties related to new technology and the associated economics. However, with regard to large centrifugal chillers, there is only one viable refrigerant alternative at this time which is HFC-134a. Replacement technologies are also well known as there are only three significant suppliers (McQuay, Trane and Carrier) and these also are well known as is the associated economics. The projects in Croatia and the former Yugoslav Republic of Macedonia were thus more of a "kick-start" than a demonstration project and the "value added" aspects are open to question. This modality needs to be given close policy review in the context of future application in relation to the HCFC phase-out.

22. Demonstration projects such as those conducted in Croatia and the former Yugoslav Republic of Macedonia may not offer the best financing modality for future HCFC phase-out/replacement projects as such an approach as evidenced in these countries presented difficulty in selecting fairly a very limited number of beneficiaries (four in Croatia and two in the former Yugoslav Republic of Macedonia). In these cases financial support was often offered where it was often not really needed and tended to ignore those in most need because of credit worthiness, knowledgeable staff, etc. Furthermore, there was no evidence to suggest that this modality enhances the potential for replication except in the enterprises or entities receiving a grant.

23. It appears from the case studies in Croatia and the former Yugoslav Republic of Macedonia that energy savings are/were not a sufficient driver for chiller replacement. The key drivers noted were repair

costs and declining availability of CFCs and the 100 per cent funding of equipment cost through the Multilateral Fund was just an added bonus.

24. A key aspect of the Executive Committee's decision to fund chiller projects was to establish the extent to which projects have a built-in potential for replication in the absence of additional resources from the Multilateral Fund. In the case of the former Yugoslav Republic of Macedonia, the potential for replication seems to have been limited to, at a maximum, to any additional chillers owned by the beneficiaries.

25. The selection of beneficiaries for the demonstration projects in Croatia and the former Yugoslav Republic of Macedonia were reportedly made in concert with the Ozone Units. However, given the generality of the beneficiary selection criteria, it is not easy to see why the selected beneficiaries were picked. Major considerations were likely ease of implementation and low transaction costs. There may therefore be a need for the Multilateral Fund to direct more of its support to those beneficiaries where the support will make a critical difference and address the credit risks associated with those enterprises which cannot afford replacement. Perhaps the concept of "additionality" as per CDM requirements would be a good idea to include or at least take into consideration in establishing beneficiary selection criteria.

26. With the demonstration project funding approach utilized in Croatia and the former Yugoslav Republic of Macedonia where the Multilateral Fund pays for the equipment and the beneficiaries pays the collateral expenses such as building changes etc., the potential for additional chiller replacements appears to depend on the will of the chiller owners themselves. Based on the experience in Croatia and the former Yugoslav Republic of Macedonia, where there is more than one piece of equipment to be replaced at an enterprise and the associated building renovation costs are high, it is the view of the beneficiaries that it would have been better to replace both or all at the same time.

27. The regulatory frameworks established in Turkey appear to have been the primary driver and success factor for successfully phasing out early consumption of CFCs. A comprehensive legal regime with supply-side controls, set in place in a timely manner is thus essential to an effective and efficient phase-out but not enough. There is no plan in place as yet in Turkey to phase out the remaining chillers, many of which are suspected to be in hospitals and other critical locations. A comprehensive strategic plan with the full engagement of all stakeholders and especially the Government is necessary for the success of phase-out sub-projects.

28. An impact analysis, if prepared in advance, can assist in improving the priorities for beneficiary selection and at the same time minimize economic disruption. Croatia banned the import of CFCs early but without any consideration of, or economic analysis of, the impacted enterprises.

29. Tax exemptions can serve as an incentive when expenditures are incurred to meet international treaty obligations. Countries should be encouraged to include such legislative measures as part of their upcoming HPMPs.

30. Uncertainty exists currently with regard to the destruction of waste ODS especially CFCs. Some may be needed for equipment still in use since the equipment suppliers will need time to fill orders beginning 1 January 2010. Also, from a country economic perspective where the largest deterrent is the unavailability of funds, rather than consider destruction of unwanted CFCs through Multilateral Fund support alone, there is also the possibility that these wastes may qualify for cost support (destruction) under the various carbon credit financing schemes. Also, it may be wise to keep these in storage as they may be needed for bridging time delays that may be encountered with chiller replacement equipment deliveries and building modifications.

31. A revolving fund modality was considered for Croatia and the former Yugoslav Republic of Macedonia and whereas these are, or can be, a very useful financial mechanism as in the case of Turkey,

they can only be deployed if implemented early enough to allow for two-three payment/re-issue cycles. This was not possible in Croatia or the former Yugoslav Republic of Macedonia. The lesson learned is that if this is to be considered in the context of HPMPs then an early start will be necessary.

32. The revolving fund in Turkey was an innovative modality that has been demonstrated to be viable. Nonetheless, greater attention was needed regarding strategic planning to ensure that such mechanisms are identified as just a part of a needed comprehensive strategy or implementation plan to facilitate the phase-out of all chillers in both the private and public sectors. This was not the case. The lesson learned is that whereas a revolving fund can be a very useful funding mechanism, it must be viewed as just one component of a more comprehensive plan to address all of the targeted components. Whereas the revolving fund was very successful in Turkey for the participants, there is no plan in place to deal with the non-participants such as hospitals.

33. In the case of Turkey, it is not certain how the public sector chillers, especially those in the 400-600 hospitals in Turkey can or will be replaced when there are no more CFCs to maintain these chillers. Based on the experience in Turkey, it was reported that a revolving fund mechanism may not have effective and efficient application to public sector conversions or replacements unless procurement and other bureaucratic procedures can be streamlined.

34. When contemplating the need for different approaches for the private and public sector, the former Yugoslav Republic of Macedonia offers an interesting situation. All factories in the country were formerly state-owned enterprises. Some have now been sold in whole or part to the private sector. Where state partial ownership is retained, it is difficult to distinguish what is public or private. This can best be characterized as a private-public partnership enterprise with its own unique set of constraints. The lesson is that flexibility is required to accommodate such situations.

35. Careful consideration needs to be given to the terms of reference (TORs) for NGO assigned project agents. In the case of Turkey, the performance indicator (PI) for the Technology Development Foundation of Turkey (TTGV) (the NGO chiller revolving fund manager and project agent) ought not to have been solely the disbursement of funds as was reported. One PI could have been creating the “kick-start” or catalytic effect (including awareness) needed to create the needed country-wide momentum for replacements. The lesson is that ministry oversight on an ongoing basis is needed.

36. Revolving fund mechanisms in future could include as a target at least some of those in most need (where participation in the fund is necessary to enable the replacement). This means less emphasis to be given to wealthy beneficiaries with their likely enhanced credit worthiness, knowledgeable and trained staff and thus lower transaction costs who indicate they will convert regardless. This could be achieved by including or at least considering a clause in the selection criteria for beneficiaries relating to “additionality”.

37. Large financial incentives may be required in some cases but not for all and perhaps not when energy saving are likely to relate to payback periods of less than five years which was the case for some in the former Yugoslav Republic of Macedonia and Turkey.

38. Special attention needs to be given to awareness raising and should be constantly reviewed if difficulty is encountered in identifying those that need most assistance from the Multilateral Fund. It appears, especially in the case of Turkey, that the only outreach appears to have been through awareness created by the chiller suppliers in their efforts to sell replacement equipment. There was no evidence to indicate that the implementing entity (TTGV) had in place any active programme to enhance participation relying largely on the suppliers to create business. This was an implementation shortfall.

39. Multi-stakeholder engagement from the onset is necessary for both problem ownership and sustainability of results and to ensure the creation of a level playing field.

40. Although there are numerous efforts being made to facilitate tripartite funding (GEF/MLF/carbon funding), and this will likely be a reality in future, based on discussions in the case study countries this arrangements remains impractical at this time due the longer processing time for project approval and the need for counterpart funding and mainly to the short compliance times dictated by the Montreal Protocol.
