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FINAL REPORT ON THE EVALUATION OF SOLVENT PROJECTS

Executive Summary

1. This report gives an overview of the solvent project evaluation approach and provides a synthesis of the main findings and recommendations of the evaluation team. The team visited five countries in Asia, one in Latin America and one in Africa, to evaluate 30 solvent projects. The evaluation team received excellent support during their field missions from both the implementing agencies and the National Ozone Units. The 30 projects visited represent a good coverage by region, implementing agency, size, year of approval, sub-sector and technology choice.

2. With only one exception, the companies visited have successfully phased out the targeted volume of ODS solvents. The 30 projects evaluated resulted in the phase-out of 487 ODP tonnes. The cost-effectiveness of solvent projects evaluated was, on average far better than the threshold values established at the 16th Meeting of the Executive Committee. Sustainability of the conversion to non-ozone depleting alternatives and the monitoring of remaining ODP solvent uses will definitely have its challenges. Conversions are likely to be permanent if the operating costs are similar to or less than for ODS solvents.

3. Although no projects were visited where CFC or TCA was still being used, two of the projects were using HCFC-141b, with an ODP value slightly higher (0.11) than TCA (0.10), in contrast to the approved technology. One company switched from HFC to HCFC-141b for cost reasons after project hand-over indicating that while the phase out was realized it was not sustained, however; another one was planning to do the same. In another case, an unauthorized technology change occurred. Moreover, in two umbrella projects in the Philippines, conversion from TCA to HCFC-141b had been approved as one technology among others, and was indeed implemented by several companies. Thus the conversion resulted in the use of an alternative with higher ODP value then the baseline ODS. HCFC-141b should never be accepted and used as an alternative for converting TCA applications.

4. Certified destruction and disposal of ODS-based equipment, has in many cases not or not fully been achieved. While no ODS-equipment was actually being used, in some cases, enterprises awaited further instructions and in others, the destruction had not resulted in making the equipment permanently unusable, and in a few companies, the fate of the old equipment could not be clarified. While equipment destruction ought to be a straightforward matter it is problematical for various reasons, including a reluctance to destroy potentially useful equipment and parts. Guidelines which are about to be finalized by the Secretariat, in consultation with the implementing agencies, would facilitate this task.

5. Implementation delays were frequent for the projects visited. Difficulties experienced by the implementing agencies and the beneficiaries were the main causes. Many of the projects were planned too optimistically. Modifying a company's cleaning process can have major implications to the overall manufacturing process and its complexity should not be underestimated.

6. The initial choice of technology and equipment was often of insufficient quality. In many projects the chosen process and/or equipment changed between project approval and completion, often radically. The selection of process and equipment technologies should be better researched, before finalizing the project documents so that subsequent substantial changes would not, or only exceptionally, be required. The solvent sector is particularly diversified in terms of technology, equipment and process choices which evolve rapidly. Nevertheless, specialized consultants, in close cooperation with staff of the beneficiary companies and, if need be, initial cleaning tests by potential suppliers, should be able to propose solutions which require radical changes after project approval only in exceptional cases, thereby avoiding implementation delays.

7. As in the non-Article 5(1) countries, aqueous cleaning is a popular choice as an alternative to Ozone depleting solvents. A third of the evaluated projects selected this option. Non-ozone depleting chlorinated solvents on the other hand, like methylene chloride, perchloroethylene, and especially trichloroethylene (TCE) were used by an unexpectedly small fraction of the completed conversions. Confusion regarding the acceptable exposure limits and acceptable emission control technology are probably the reason, an issue which should be rapidly clarified, in view of the increasing number of recently approved conversions to TCE and further projects under preparation.

8. Project implementation nearly always improved the baseline environmental and safety conditions. However, there were only two or three projects evaluated where the consultants found little risks while in the majority they represent a topic of concern. More emphasis is necessary in project on safety, health and environmental impact to ensure that the conversion is achieved while respecting appropriate safety and environment protection standards.

9. While in most cases Incremental Capital Cost (ICC) were carefully calculated in the project documents, for several projects these costs had been largely overestimated. However, resulting savings were not returned to the MLF but were used to reduce counterpart funding which had been committed to compensate substantial Incremental Operating Savings (IOS). Savings during project implementation might arise from buying cheaper equipment and/or realizing lower Incremental Operating Cost (IOC) or higher IOS than anticipated and approved. Such savings should be reported in the Project Completion Report (PCR) and a pro-rata amount corresponding to the share of grant funding in the total eligible incremental cost be returned to the Multilateral Fund. Beneficiaries should respect their commitment to contribute to the cost of conversion when grant funding has been reduced due to foreign ownership, exports to non-Article 5 (1) countries or projected IOS.

10. Further lessons learned and actions recommended can be found in sections XVIII and XIX of the report.

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I Introduction

1. This paper gives an overview of the evaluation approach and provides a synthesis of the main findings and recommendations of the evaluation team who visited five countries in Asia, one in Latin America and one in Africa, to evaluate 30 solvent projects (for details about the countries and projects visited see Section IV below).

2. Both country evaluation reports (CER) and project evaluation reports (PER) were sent to the countries and Implementing Agencies concerned for comments. They are available on request, and their final versions will be placed on the Secretariat's web site, in the section "Executive Committee", evaluation reports.

II Evaluation process

3. The evaluation proceeded with the following steps:

(a) in-depth desk review by a consultant studying the documentation, identifying evaluation issues and proposing projects for field visits;

(b) preparation of a summary by the Senior Monitoring and Evaluation Officer and presentation to the Monitoring, Evaluation and Finance Sub-committee at the 32nd Meeting of the Executive Committee (Section VI of document UNEP/OzL.Pro/ExCom/32/19), which took note of the proposed evaluation approach;

(c) visits of consultants to the selected sample comprising 30 projects in Asia, Africa and Latin America during 2001;

(d) preparation of evaluation reports by consultants on each project and country reports on each country visited; the country reports analyze the solvent sectors of the countries in terms of past achievements and remaining tasks for ODS phase out;

(e) preparation of the present synthesis report by the consultants in cooperation with the Senior Monitoring and Evaluation Officer.

III Evaluation team, support by the Ozone Offices and Implementing Agencies

4. The consultants have been recruited on the basis of a direct search for appropriate candidates. Two consultants were chosen, one from U.K. and one from U.S.A. The consultants were chosen for their:

(a) experience with conversion from ODS-based production in solvent companies to non-ODS substitutes;

(b) neutrality in terms of not being consultants to the Montreal Protocol units of the Implementing Agencies;

(c) Knowledge of the Multilateral Fund and the functioning of the UN system; both consultants are long time members of TEAPs Solvents Technical Options Committee (STOC).

5. In three countries (Thailand, Malaysia, India), the Deputy Chief Officer of the Multilateral Fund Secretariat responsible for solvent projects accompanied the consultants in order to provide them with information about policies and guidelines of the Multilateral Fund. The Senior Monitoring and Evaluation Officer participated in field visits in the Philippines, Thailand and China, in order to supervise the work of the evaluation team and to support the fine-tuning of the evaluation approach.

6. The governments of all countries visited had been informed beforehand, and their concurrence had been obtained. The evaluation missions were very well received and supported by the Ozone Offices in the countries visited. The Ozone Officers prepared the visits to the companies and accompanied the evaluation team. Information requested on companies and national policies, including experiences gained during project implementation, were readily provided. In most visits, representatives of the companies were cooperative and accessible, although often not prepared to provide figures on previous years performance and cost.

7. In spite of the short notice of the missions, the Implementing Agencies were supportive as well. UNIDO sent a Project Officer to accompany the evaluation mission on visits to companies in India, Egypt, Brazil and China. The UNDP Project Officer for solvent projects in China accompanied the mission during project visits in this country and the Deputy Chief of the Montreal Protocol Unit of UNDP accompanied the mission in Brazil. Staff of the World Bank's financial intermediaries and of local UNDP offices met the missions when required and accompanied them on some company visits.

8. The Implementing Agencies submitted project completion reports (PCRs) for all but six projects, some of them shortly before the visits. The PCRs were useful in terms of preparing and structuring the discussions in the enterprises, in spite of the fact that they often lacked important quantitative information, which was difficult and sometimes impossible to obtain during the interviews, particularly with regard to previous ODS consumption and production figures and details of incremental capital and operating costs.

IV Sample of projects visited

9. The total number of 30 projects visited represents a good coverage by region, implementing agency, size, year of approval, sub-sector and technology choice. The 30 projects evaluated represent 43% of all 70 solvent projects completed until the end of 2000, and 31% of 96 solvent projects approved until July of 2001 (34th Executive Committee Meeting).

10. Most solvent projects visited were in Asia (21), followed by Africa (5) and Latin America (4) [see Table 1].

Table 1: By Region

Region	Latin America & Caribbean	Asia	Africa	Europe
Projects Evaluated	Brazil 4	China 8[1]	Egypt 5[2]	
		Malaysia 4		
		India 3		
		Thailand 3		
		Philippines 3		
Total	**4**	**21**	**5**	**0**
All Projects Completed	**12**	**48**	**7**	**3**

[1]In addition, the project CPR/SOL/28/INV/287 near Xi'an was visited but not formally included in the evaluation because it is still on-going. As this is the largest single investment project in the solvent sector presenting interesting and controversial technology choices, an individual report has been prepared, nevertheless.
[2]Three sub-projects under EGY/SOL/18/INV/52 are counted as one project.

11. The evaluation covered projects implemented by all three Implementing Agencies (see Table 2).

Table 2: By Implementing Agency

Implementing Agency	Number of Projects Completed	Number of Projects Evaluated	Percentage
UNDP	18	12	66%
UNIDO	26	11*	42%
WORLD BANK	26	7	27%
TOTAL	**70**	**30**	**43%**

*Includes 3-sub-projects under EGY/SOL/18/INV/52 counted as one.

12. The sample included projects of all sizes in terms of funding. Although the emphasis was on projects of medium size, some relatively small and some large projects were also included.

Table 3: By Size

	Under US $ 100,000	US $ 100,000-500,000	US $ 500,000-1,000,000	Above US $ 1,000,000	Total
Number of Projects Completed	18	41	9	2	70
Number of Projects Evaluated	5	21	4	0*	30
%	**28%**	**51%**	**44%**	**0%**	**43%**

*On-going project CPR/SOL/28/INV/287 was visited.

13. As the following table shows, care was taken to select projects that were approved and completed in different years in order to identify trends and the effects of policy changes.

Table 4: By Year Approved

Year of Approval	Number of Projects Approved	Number of Projects Completed	Number of Projects Evaluated	Percentage (evaluated/ approved)	Percentage (evaluated / completed)
1991	2	2	0	0%	0%
1992	2	2	0	0%	0%
1993	13	13	3	23%	23%
1994	8	8	5	63%	63%
1995	18	18	9	50%	50%
1996	16	12	9	56%	75%
1997	11	8	3	27%	38%
1998	8	7	1	13%	14%
1999	9	0	0	0%	N/A
2000	4	0	0	0%	N/A
2001	5	0	0	0%	N/A
Total	**96**	**70**	**30**	**31%**	**43%**

14. Care was also taken to include as much as possible projects from all sub-sectors into the sample, as shown in Table 5 below:

Table 5: Selected Projects for Evaluation by Sub-sector

Solvent Sector	Total No. of Projects Approved (July of 2001)	Total No. of Projects Completed (end of 2000)	Selected Projects for Evaluation 2001	% of all Approved Solvent Projects	% of all Completed Solvent Projects	MLF Disbursed Grant for Projects Evaluated (end of 2000, in US$	% of Disbursements (evaluated / completed)
CFC-113	34	25	10	29%	40%	2,202,094	26%
TCA	32	27	11	34%	41%	2,357,266	53%
Combined CFC-113 and TCA	10	8	3	30%	38%	465,956	18%
CTC	8	2	0	0%	0%	N/A	N/A
Multiple Solvents	11	8	6	55%	75%	2,001,001	70%
Sectoral Phaseout Plan	1	0	0	0%	N/A	N/A	N/A
Total	**96**	**70**	**30**	**73%**	**43%**	**7,026,317**	**37%**

15. CTC projects were not included because the DPR Korea where the two completed CTC projects are located was not visited as another trip would have been required just to visit these two projects. The China solvent sector strategy was discussed during the visit of the evaluation team in China and is briefly analyzed in the country report on China. As implementation has only recently started, it was considered too early for a mid-term evaluation.

V Evaluation issues and data collection approach

16. Detailed evaluation issues and terms of reference for the evaluation were presented to the 32nd Meeting of the Executive Committee in document UNEP/OzL.Pro/ExCom/32/19, p. 23-24:

(a) Analyze cases where the ODS phase out does not appear to be transparent, inconsistent or less than approved, assess the viability of technology chosen and the risk of returning to the use of ODS and describe remaining tasks for phase out in cases where no final solution have been achieved so far.

(b) Identify the reasons for the frequent implementation delays, systematize them and propose solutions to overcome repeated bottlenecks.

(c) Review the reasons for the frequent changes of technology during project implementation. Related to changes of technology, frequent changes of incremental capital costs occur. The evaluation will try to analyze whether and how it will be possible to estimate cost of equipment more precisely during project preparation.

(d) Identify ways to cope with difficulties encountered during project preparation leading to insufficient evaluation of all possible technological alternatives, which in turn may result in changes of technology during implementation.

(e) Review cases where the conversion has led to significant increases of production capacity, procurement of additional equipment like testing instruments or automatization which had not been part of the original equipment, and might therefore not have been eligible for funding.

(f) Establish actual incremental operating cost or savings for which information provided in the PCRs to the Multilateral Fund Secretariat is generally poor.

(g) Examine safety and environment issues, including baseline conditions, in project preparation, implementation as well as in reporting.

(h) Analyze experiences made with small projects in order to generate lessons of how to deal in future with such projects that might become more frequent.

(i) Trace the fate of the old equipment, which is supposed to be destroyed or dismantled, and discuss possible and cost effective ways of rendering such equipment unusable.

(j) Identify successful management approaches to organize the conversion efficiently within the company and in cooperation with the relevant Government authorities, the Implementing Agencies and the suppliers of equipment and materials.

(k) Assess the role of training activities and policy regulations for successful completion of projects.

(l) Test the project completion report in its new format and identify difficulties for improving the quality of project documents as well as project completion reports.

17. The format used for the project evaluation reports (PERs) is largely identical with sections I, II and III of the revised project completion report (PCR) format for investment projects. It served as an interview guideline in the companies visited and as a format for entering the data collected.

VI PROJECT COMPLETION

18. According to Decision 28/2 of the Executive Committee, completion of a project means:

(a) "No further use of CFCs is in evidence;

(b) that the alternative product is being produced and/or production has begun; and

(c) that the CFC-using equipment has been destroyed/dismantled/rendered unusable with CFCs."

19. Using this decision as a reference, the new overall assessment scheme in the revised project completion format for investment projects has been designed in a way that 20 points are given for each of these criteria if they are fulfilled (see overview table in Annex I which applies this new rating scheme to the projects evaluated). For the 30 projects evaluated, the results are shown in Tables 6a and b below:

Tables 6 a and b: Completion of Projects Evaluated According to Decision 28/2 of the Executive Committee

a) For 20 Projects Completed Before July 1999

Completion criteria	Number of projects fulfilling these criteria		
	Yes	No	N/A*
a) No further use of CFCs is in evidence	19	0	1
b) Alternative product is being produced and/or production has begun	17	1	2
c) CFC-using equipment has been destroyed/dismantled/rendered unusable with CFCs	11	7	2

*Not applicable

b) For 10 Projects Completed After July 1999

Completion criteria	Number of projects fulfilling these criteria		
	Yes	No	N/A*
a) No further use of CFCs is in evidence	9	0	1
b) Alternative product is being produced and/or production has begun	7	2	1
c) CFC-using equipment has been destroyed/dismantled/rendered unusable with CFCs	4	5	1

*Not applicable

20. Tables 6 a and b show that in spite of the fact that the Implementing Agencies had declared all projects evaluated as completed, not all criteria for project completion have been fulfilled in a number of projects reported as completed before and also after Decision 28/2 was taken in July 1999. In three projects alternative production has not yet started and in 12 projects the destruction or disposal of old equipment has not been completed (for more details see

Sections VII, VIII and IX below). Only 19 projects had been financially closed at the time of the 2000 Progress Reports. In a number of cases shown in the overview table in Annex I, balances have been returned to the Multilateral Fund. For one financially completed project, there are still funds to be returned (BRA/SOL/18/INV/39). 11 projects are still awaiting financial completion while some of these projects were completed only during 2000 or 2001, in four cases declared physical completion dates back to 1999, and in one case each to 1998 and 1997.

VII OD Solvents Phased Out and new production started

21. The main positive result is that with only one exception, the companies visited have successfully phased out the targeted volume of ODS. Successful phase-out means that no more Ozone Depleting Solvents are used in the company (other than HCFC solvents approved for phasing out CFC-113). In this case, the original baseline consumption of CFC and TCA, as confirmed or corrected by the evaluation, has been eliminated, irrespective of the current production level and quantities of substitutes used.

22. Although no projects were visited where CFC or TCA was still being used, two of the projects were using HCFC-141b, with an ODP value slightly higher (0.11) than TCA (0.10), in contrast to the approved technology. One company switched from HFC to HCFC-141b for cost reasons after project hand-over indicating that while the phase out was realized it was not sustained, however; another one was planning to do the same. In another case, an unauthorized technology change occurred. Moreover, in two umbrella projects in the Philippines, conversion from TCA to HCFC-141b had been approved as one technology among others, and was indeed implemented by several companies. Thus the conversion resulted in the use of an alternative with higher ODP value then the baseline ODS. HCFC-141b should never be accepted and used as an alternative for converting TCA applications.

23. Total phase-out for evaluated projects was 487 ODP tonnes which was 57 ODP tonnes more than called for in the project documents. Nearly the entire additional amount was due to an Indian project for medical equipment sterilisation (see table in Annex 1).

24. The baseline ODS consumption figures in the project documents could not be accurately verified by the evaluation team. Such verification would have required checking of everyday purchasing records of the company, which was not possible due to the lack of time and sometimes communication difficulties in the local languages.

25. In a number of projects visited in various countries, actual production levels were low, considering the installed capacity of the equipment after the conversion. One plant appeared to be at a standstill. It is nevertheless emphasised that this does not necessarily mean that the installed capacity was too great, rather the beneficiary was suffering a severe downturn in business.

26. Participation of National Ozone Units or local Consultants in the collection of ODS consumption data is crucial, especially when verification of data involves checking the enterprise's records, available only in local languages. The ODS consumption calculated in the enterprise should be corroborated by information on ODS imported available from importers and customs records as soon as an import licensing scheme has been put in place. Invoices for the purchase of ODS presented by the enterprises should, as much as possible, be certified by the National Ozone Unit and should be kept on record for future verification.

27. The baseline figure for ODS consumption of solvents blends requires special care because the effective ODP is always lower, pro-rata to the percentage weight of the actual ozone depleting solvent. For example, a CFC-113/methanol azeotrope contains only about 94% by weight of CFC-113, so that its effective ODP is 0.94 x 0.8 = 0.75. Several baseline figures had errors because such blends had been calculated with an ODP of 0.8.

VIII Sustainability of conversion and monitoring of remaining CFC consumption

28. Sustaining the conversion to non-ozone depleting alternatives will definitely have its challenges. The consultants are pleased to report that, in 27 of 30 projects evaluated, a sustained conversion seems likely. However, if reversion is technically simple and ongoing operating costs are lower with ozone depleting solvents, it cannot be guaranteed. However, companies will not revert to the use of ozone depleting solvents once the non-ODS process is in place and performing with equal or lower operating costs and better quality than would be experienced with a reversion. In a situation like this, there is no economic incentive to go back to using the ODS solvents with higher operating costs.

29. Operating costs for the projects evaluated appeared to be lower for projects that converted to aqueous, semi-aqueous or non-ozone depleting chlorinated solvents, as opposed to conventional non-halogenated organic solvents for example. Of course, this is a very general statement and it depends greatly on many project-specific variables. Projects evaluated that had either already reverted back to ozone depleting solvents, or expressed plans to do so, were those with high ongoing operating costs for the substitutes.

30. The real issue is that certain projects have cleaning challenges that just cannot be met with lower operating cost, water-based, cleaning techniques. In these cases, expensive (high production cost and low sales volume) speciality solvents have to be imported to clean the part successfully and phase out ODS solvents used by the beneficiary. As soon as the original allotment of expensive non-ODS solvent is used up, the company turns to the transitional solvents such as HCFC 141b, at one-tenth the price. Of course, this ultimately delays the phase-out effort, as well as giving the beneficiary additional operating savings, which are often very considerable.

31. One other hindrance to the phase-out effort is, of course, illicit imports of ODS solvents. Several chemical-blending companies evaluated stated that inexpensive ODS solvents continued to put economic pressures on converted companies. It is difficult to compete by selling the more expensive non-ODS solvent blends. It was further explained that although leveraging the "environmental friendliness" of their non-ozone-depleting products helped, it was not enough to offset the ongoing pricing pressures.

32. There were no specific lessons learned, from the project evaluations, for monitoring of the remaining ODS solvent consumption. In general, this will be one of the more difficult tasks for the NOUs and their local agencies, in some countries. Most countries visited have not completed their ODS solvent consumption phase-out effort and therefore, do not know what to expect regarding illegal imports. In the case of the Philippines where phase-out was completed in 1997, the NOU still had concerns about the ability of the customs and coast guard to monitor a vast shoreline for illegal imports of ODS solvents. These concerns were echoed by the companies visited. In several cases, they spoke of competitors still obtaining a steady supply of "controlled" solvents, illegally imported.

33. China and its Solvents Sector Plan offered the only unique modality seen for converting the small users. Their system of vouchers and demonstration facilities with available technical assistance will be watched closely. However, even this may not be enough for a country as large as China. In the end, it will likely come down to a closing of the production taps and a somewhat rough transition from ODS solvents for small users, probably causing economic hardship to enterprises and even communities. Of course, this will inevitably be accompanied by years of efforts to control illicit trade in these substances.

IX Equipment destruction

34. Certified destruction and disposal of ODS-based equipment, has in many cases not or not fully been achieved. While no ODS-equipment was actually being used, in some cases, enterprises awaited further instructions and in others, the destruction had not resulted in making the equipment permanently unusable, and in a few companies, the fate of the old equipment could not be clarified. While equipment destruction ought to be a straightforward matter it is problematical for various reasons, including a reluctance to destroy potentially useful equipment and parts. Guidelines which are about to be finalized by the Secretariat, in consultation with the implementing agencies, would facilitate this task.

35. While retrofitted equipment is not to be destroyed, it must be realized that many retrofitted cleaning machines can easily be used with ODS solvents without removing the retrofitting, in most cases with improved efficiency. This underlines the importance of reducing and finally eliminating the supply of ODS - solvents ("closing the tap") and at the same time enabling companies to gain access to non-ODS substitutes at competitive prices (see also Section VIII above on sustainability of conversion).

36. It is suggested that in all cases model and serial numbers or some other positive identification, be included in both the project documents and the PCR, in order to ensure correlation. It would be very helpful to have photographs of intact machines in service in the project documents and then of the machines being destroyed or after destruction in the PCR.

37. By far the most common comment from the beneficiary on this topic was that they were unclear on the correct method to proceed to a certified destruction. For this reason, in many cases, they chose to store the equipment until direction was provided. In several cases, the Mission provided such direction.

38. The Secretariat, in cooperation with the implementing agencies, is currently drawing up destruction guidelines. In the case of vapour phase cleaning machines (the most common case for solvent projects), the Consultants recommend:

- The cooling coils be cut from top to bottom, at least once
- Each tank have at least one hole of 25 mm diameter or six holes of 10 mm (minimum) diameter pierced (drilled or punched) in or close to the bottom (just one or two small holes may easily be repaired).
- Any pumps, heaters and thermostats removed
- Any ultrasonic transducers and electronics removed and trashed
- All pipework be cut
- All electrical wiring be cut
- All scrap metal be sent to a qualified scrap metal merchant for recycling.

39. For other types of equipment, a project specific protocol along similar lines should be established and the destruction / disposal procedure already be defined and agreed upon in the Project Document.

X Implementation delays

40. Delays of more than 18 months occurred in 13 projects, 13-18 months delays are recorded for five projects, four projects had delays of between seven and 12 months, six projects were completed as planned or nearly as planned (0-6 months delay) and two projects earlier than expected (see Table 7 below).

Table 7: Implementation Delays of Projects Evaluated by Implementing Agency

Agency	Implementation Delays in Months					
	Early Completion	**0-6**	**7-12**	**13-18**	**More than 18**	**Total**
IBRD	0	3	1	2	1	7
UNDP	2	1	2	0	7	12
UNIDO	0	2	1	3	5	11
Total	2	6	4	5	13	30

41. The actual duration of projects evaluated does not show remarkable differences by implementing agency; all agencies have no projects completed under 12 months and 13 projects, the majority by UNDP, exceeded 36 months duration (see Table 8).

Table 8: Actual Duration of Projects Evaluated by Agency

Agency	Actual Duration in Months					
	0-6	7-12	13-18	19-36	36 and More	Total
IBRD	0		0	3	4	7
UNDP	0	0	3	2	7	12
UNIDO			0	9	2	11
Total	0	0	3	14	13	30

42. Implementation delays have been significantly less pronounced for projects approved in 1997 and 1998 than in earlier years, while the average approved project duration and the average actual project duration remained largely unchanged.

43. The reasons for implementation delays are nearly as varied as the number of projects themselves. The PCR has six main categories to report delays, namely:

- implementing agency delays
- enterprise delays
- equipment supplier delays
- governmental delays
- external (regional/global) factors
- delays in funding following project approval.

44. By an overwhelming majority, the first two categories were given as the main reasons for project delays. Additionally, these two offer the greatest opportunity for improvement from lessons learned. Although customs procedures were often named as a cause for governmental delays, the exact reason varied greatly by situation and no advice can easily be offered. Implementing agencies contributed to implementation delays for three main reasons;

(a) International solvent experts underestimated the amount of time required to implement various phases of the project (this is undoubtedly the most important of all causes).

(b) Extra time was required for writing the technical specifications for equipment purchases (most often because of technology changes being required or "fitting the equipment to the available funding").

(c) The ODS substitute and/or the equipment or process were frequently changed from what was approved by the Executive Committee. This points to weaknesses in project preparation and caused delays in many projects.

45. In general, large enterprise beneficiaries have a distinct advantage for meeting the challenges from a conversion project. They are typically more process-oriented and usually have well trained specialists that can get into the details of the project and provide a guiding hand and true counterpart for technical discussions. Small-to-medium sized projects, on the other hand, struggle with change, change that often represents a high risk to their business. Without engineering resources of their own, the smaller companies are forced to rely on the outside expert/consultant who may not always be familiar with the intricacies of their particular production process.

XI Technology choice and selection of equipment

46. The 30 solvent projects evaluated had recorded 42 different conversion technologies. In some projects, two or three different technologies were applied. As shown in Table 9 below, the technology most often chosen as an alternative for both TCA and CFC-113 was aqueous cleaning (in 6 and 8 cases respectively). No clear pattern emerges from the choices made between the numerous other options.

47. It is surprising that in only a few cases, projects choose non-ozone depleting chlorinated solvents for the conversion. Non-Article 5(1) countries industries rely heavily on carefully controlled use of methylene chloride, perchloroethylene, and especially trichloroethylene (TCE). It is particularly interesting that TCE was never chosen as a replacement for TCA in the earlier projects, especially when you consider that TCA originally became popular as a replacement solvent cleaner to the very similar but more toxic TCE. Uncertain toxicity may be a primary reason for aversion to this technically excellent OD solvent alternative. During the evaluation it became obvious that there is much confusion regarding acceptable exposure limits and acceptable emission control technology. For one major Article 5(1) country, the evaluation team was never able to establish the regulatory exposure limit for TCE. This is unfortunate because in many cases TCE is both technically and economically the preferred solution. Without chlorinated solvents, it is very likely that OD solvents phase-out in non-Article 5(1) countries would not have been completed as early as 1996. It would be useful if the Solvent Technical Option Committee (STOC) publishes an addendum to their report to specifically address the use of non-ozone depleting chlorinated solvents in Article 5 countries. Such clarification is also required in view of the increasing number of recently approved conversions to TCE (six in 2000/2001 as compared to a total of eight in the years before), and further projects are under preparation.

48. With respect to the financial side, converting to TCE or some other low-cost products, including water, does create problems for formulating a project which is attractive to potential beneficiary companies, especially with retrofitted equipment, because of significant IOSs. As a result, the eligibility for grant funding might be very limited or even negative. There is no easy solution to this difficulty within the framework of the current funding policies, especially with respect to SMEs, which often have difficulties to mobilize own or local funding sources for the conversion.

Table 9: Technology Choices as per Inventory of Approved Projects*

Technology Choice	Total No. of Technology Choices Completed	No. of Technology Choices Evaluated	Percentage Evaluated
CFC-11 to Compressed filtered air	1	1	100%
CFC-11 to Hydrocarbon	1	1	100%
CFC-113 to Aqueous cleaning	20	8	40%
CFC-113 to Equipment modification	1	1	100%
CFC-113 to HCFC-141b	1	1	100%
CFC-113 to Heat cleaning	3		0%
CFC-113 to Hydrocarbon	4	2	50%
CFC-113 to Isopropyl alcohol	1		0%
CFC-113 to No clean	2	1	50%
CFC-113 to Non-chlorinated solvent	2		0%
CFC-113 to Recycled	1		0%
CFC-113 to Semi-aqueous cleaning	7	4	57%
CFC-113 to Trichloroethylene	2	1	50%
CFC-12 to Aqueous cleaning	1		0%
CFC-12 to Carbon dioxide-Ethylene oxide	1	1	100%
CFC-12 to HFC-134a	2	2	100%
CTC to Trichloroethylene	2		0%
TCA to Aqueous Cleaning	20	6	30%
TCA to Chlorinated esther solvent	2	1	50%
TCA to HCFC-141b	2	2	100%
TCA to Hydrocarbon	6	3	50%
TCA to Isopropyl alcohol	1		0%
TCA to No clean	1	1	100%
TCA to Non-chlorinated solvent	4	3	75%
TCA to Recycled	1		0%
TCA to Semi-aqueous cleaning	2	3	150%
TCA to Solventless system	1		0%
Total	92	42	46%

*Later unapproved technology changes are not reflected; one project may use more than one conversion technology.

49. The initial choice of technology and equipment was often of insufficient quality. In many projects the chosen process and/or equipment has changed between project approval and completion, often radically. The fact that most projects do end up by achieving their aim is good but many of them do not employ the most cost-effective means and methods.

50. It seems that "lessons learned" are not followed up systematically, particularly between similar projects executed by different implementing agencies. For example, the “Proton” project in Malaysia, which was very successful, was similar in cleaning scope and application to the “Technopol” project in Egypt, which showed a relatively poor choice of both process and equipment. Similarly, a common problem in many countries is the cleaning of refrigeration and air-conditioning heat exchangers. Each one of these projects seems to choose a different technology, with widely varying costs per part and efficiency.

51. Much equipment is chosen without full regard to the environmental consequences. For example, three machines for electronics cleaning, supplied to two Chinese projects, were chosen for having “no waste streams”. However, no disposal methods for highly polluting products and heavy metal salts were foreseen in the project. The choice of equipment for the conversion should not be made because of a single attractive characteristic at the expense of a comprehensive assessment of all the implications.

52. One project in particular (ERL, India), and some others less strikingly, presented a significant technological upgrade compared to the baseline equipment. This was possible because of the unnecessarily wasteful use and the resulting high baseline consumption of CFC-113 which allowed a corresponding high project budget after application of the cost effectiveness threshold. It is suggested that equipment selection be made with a notion of average OD solvent consumption for a given technology.

53. Many projects chose expensive equipment and products from non-Article 5(1) countries when satisfactory equipment and products, usually more economical, were obtainable from local sources or from a neighbouring Article 5(1) country. The bidding process does not always seem to explore these possibilities.

XII Change of Technology

54. In a few projects, the implementing agency expert/consultants had suggested a very suitable alternative to ODS solvents, or even an obvious one which has been approved. The enterprise has subsequently changed the approved technology, sometimes for no apparent reason or for an illogical one. This has resulted in unsatisfactory cleaning results, increased costs (often at their own expense) and even dissatisfaction with the funding mechanism. It could be argued that the project document was originally not adequate. Lack of beneficiary involvement in the writing of the project document is probably more often the case. It is suggested that the NOU and the implementing agency actively discourage this line of action unless there is an imperative and logical reason that receives approval from the Executive Committee.

55. The selection of process and equipment technologies should be better researched, before finalizing the project documents so that subsequent changes would not or only exceptionally be required. While the solvent sector is particularly diversified in terms of technology, equipment and process choices which evolve rapidly, specialized consultants, in close cooperation with staff of the beneficiary companies and, if need be, initial cleaning tests by potential suppliers, should be able to propose solutions which require radical changes after project approval only in exceptional cases, thereby avoiding implementation delays.

56. In at least four cases, UNIDO, to match the funds approved, has changed either the technology or the equipment in the approved project proposal. To give a hypothetical example, a project is estimated at USD 200,000 with IOSs of USD 50,000 and foreign participation or exports of 50%, resulting in an approved budget of USD 75,000. Equipment is subsequently purchased at a capital cost of USD 75,000, meaning that there is no counterpart funding, despite the subsequent operational savings and foreign ownership/exports. This is a very doubtful practice, which can mean only one of two faults: either the project document exaggerated Incremental Capital Costs or the equipment supplied is less-than adequate for the job. It is therefore necessary for the NOUs, IAs and the beneficiaries to understand that counterpart funding is really required under such circumstances.

57. A number of projects have undergone modifications before, and in the majority of the cases after, the 22nd Meeting of the Executive Committee which were not reported back to the Secretariat. In accordance with Decision 22/69 technology changes made after the 22nd Meeting should be submitted for approval by the Executive Committee, and major as well as minor changes should be clearly reported in the PCR.

58. The lack of clear reporting in the PCRs on technology and equipment changes has seriously hampered the efficiency and effectiveness of the Evaluation Mission. While minor changes may not need review, the historical record should in any case be made clear with an explanation of the reasons.

XIII Project cost and funding levels for incremental capital costs (ICCs) and incremental operating costs (IOC's)

59. The consultants found that in most cases ICC were based on reasonable estimates for capital equipment. In less than 10% of projects, small ancillary equipment was purchased that could be argued to be additional capacity for the beneficiary. Examples include testing equipment for product cleanliness when none was required before or the purchase of a solvent still when none was used with the baseline equipment. Even more rare was an apparent increase in production capacity for the beneficiary. There were isolated cases where batch equipment was replaced with conveyorised equipment, for example. By far the largest problem with ICC was record keeping. More times than not, it was impossible to determine the actual capital invested during the project by reading the PCR. A discussion of proposed remedies for this important issue can be found in section XVII d below.

60. Determining incremental operational costs (IOC) is always a difficult exercise in forecasting and reporting. For this reason, it can be expected that the figures from the Project Document and PCR would differ. However, one of many problems with the IOC for a project was that often the PCR reported actual IOC experienced exactly equal to plan. Many times, no actual figures were available at all. Record keeping of the actual IOC/IOS experienced by a company over the forecast four year period is critical for meaningful project evaluation. Even more important are the potential lessons learned for future projects. Because of the many possible alternatives in the solvent sector it is often difficult to determine the best of several alternatives. Good historical information on solvent projects would be an invaluable source of information to aid alternative selection.

61. The second most important issue regarding IOC/IOS is the potential for over- or underestimating them in order to subsidize ICC. The consultants evaluated several projects that projected large IOS. In order to determine MLF grant funding IOS are subtracted from the estimated ICC. In the cases in question, after approval, the projects were completely re-planned using the MLF grant funding as the total project budget! Instead of new machines with potentially lower operating costs the beneficiary would use grant funding to retrofit used equipment or buy into some other less capital intensive solution – always without approval. These projects were looked at as a success because little or no investment was required by the beneficiary and budget stayed below grant levels. Ironically, the actual IOC (as previously described, never recorded) may be much higher with the old retrofit system and in the long run the beneficiary may lose significantly by paying elevated IOC. Worse yet, the non-approved alternative may simply not work.

62. Another issue with IOC/IOS was the co-mingling of IOC and ICC funding in the PCRs. This should be avoided because it makes it impossible to financially evaluate projects. If the scope of the project changes significantly, the IOC/IOS should be re-calculated.

63. Sometimes IOC/IOS calculations were too simplistic and in nearly all cases things like waste treatment, environmental protection and health and safety issues were not fully considered. It is apparent that the standard checklist used to prepare the IOC/IOS analysis needs to be expanded to include these items. Ultimately, the exercise should consider the full impact of the project on the operational costs of the company, especially when a change in the beneficiaries cleaning process impacts other processes within the factory or even customer and supplier relations.

XIV Cost Effectiveness

64. At the 16th Meeting of the Executive Committee, it was decided that for future projects, cost-effectiveness thresholds would be applied. The record of the evaluated solvent projects compared to these thresholds is shown in Table 10 below and in Annex II. One CFC-113 project in the Philippines and one TCA project in Thailand, both with a very unsatisfactory cost effectiveness, had been approved before the 16th meeting and are not included to avoid distortion of the average. The cost-effectiveness of CFC-113 solvent projects was, on average clearly better than the threshold; likewise for TCA projects the average cost-effectiveness was largely better than the threshold.

Table 10: Average Actual Cost Effectiveness of Evaluated Solvent Projects

Sub-sector	Number of Projects	Average Actual Cost - Effectiveness	Cost-Effectiveness Threshold
CFC-113	9	14.92	19.73
TCA	11	24	38.50
Combined And Multiple Solvents	10	See calculations for the individual projects in the PERs	Weighted averages of thresholds for CFC-113 and TCA were applied.

65. For the projects phasing out several types of solvents usually weighted averages are calculated to determine the cost-effectiveness before they are approved. Their actual cost-effectiveness is analyzed in the individual PERs. 10 projects evaluated combined their phase-out effort for CFC-113 with that of TCA or other solvents. All 10 projects were approved after the 16th meeting and therefore were required to meet threshold limits. However, because budgets for different sub-projects were usually not clearly separated but combined into one project it was not possible to determine if each sub-project met the threshold requirements. If a project consists of several conversions in one company, with different sub-sectors being involved, the individual sub-projects should be treated independently with separate costings and cost-effectiveness thresholds.

XV Environmental and Safety Risks

66. Project implementation nearly always improved the baseline environmental and safety conditions. However, there were only two or three projects evaluated where the consultants found little related risks while in the majority they represent a topic of concern.

67. Many projects use strong alkalis for cleaning or for regenerating de-ionised water columns. An accidental splash of such a product in the eye would cause the victim much immediate pain and he would instinctively shut his eyes: he could have permanent damage to the eye if the product is not washed out within 30 seconds and permanent blindness within 2 minutes. Yet few enterprises supplied proper chemical goggles for the persons using these products, let alone install an eyewash basin, which would be considered mandatory in developed countries. Of course, this is an extreme, but common example. All projects employing alkaline detergents, bases or acids should include at least basic protection and an eyewash basin in each place where the products are used or stored, as well as a first aid kit with antidotes.

68. Where organic solvents are used, there are usually toxicity concerns, no matter their composition. It is therefore an excellent idea to monitor exposure levels with a “sniffer tube”. It is also recommended that such measurements be made and the values included in any project document involving retrofitting solvents equipment for use with a non-ODS solvent. This will be useful in judging the type and extent of retrofitting required.

69. Active carbon filter gas masks should be provided, as part of the project, in every case where volatile solvents are to be employed, so that a major spill or similar accident can be dealt with promptly. The filters should be checked on a regular basis and changed after use. In one project in Malaysia, exposure to non-ODS solvent at one workstation (cleaning product from re-used drums) was so high that the company found it necessary to frequently rotate employees. A better solution for all would have been to control worker exposure using the described masks.

70. Suitable fire extinguishers should be placed close to every machine employing flammable or combustible solvents. This has been consistently overlooked in many projects.

71. One of the most common faults observed throughout the mission is the lack of means of retention in the event of an accidental leak occurring in a machine or in a storage drum. Any equipment or container containing a solvent, any chemical or a cleaning solution must be placed so that if the entire contents leak, they are safely retained in a suitable metal tray, an epoxy-coated or other resistant floor with retaining weirs or walls. On no account should it be considered that a bare wooden, plastic, concrete or cement floor be adequate, because they will be sufficiently porous to allow the leak to enter the soil, potentially causing dangerous pollution to neighbouring ground and underground water.

72. Another very weak point is labelling. All areas where chemicals are used should have all the appropriate symbolic warning labels clearly visible (and renewed, if necessary). Where equipment or a chemical is supplied with safety or health warnings in plain text, these must always be supplemented with corresponding labels in the local vernacular(s). Operators must always be trained to understand the warnings, which are there for their own well-being.

73. All these points apply equally to storage areas, as well as to equipment workshops. In particular, drums or tanks must never be stored outdoors without properly designed protection. Drums of volatile solvents may even explode if left in direct sunlight or, at the best, be buckled in such a way that they be mechanically weakened. Even empty drums should be stored under cover as residual quantities of solvents can cause a dramatic pressure increase, especially with low boiling-point solvents, such as methylene chloride, HCFCs, etc.

74. More emphasis is necessary in project documents and PCRs on safety, health and environmental impact. The fate of both the chemical cleaning agent and the soils cleaned from the parts should be followed from the entry into the factory to their final disposal. More details on protection of personnel are also desirable and, the measures and funding needed to ensure that the conversion is achieved while respecting appropriate safety and environment protection standards should be included in the project document.

XVI Overall rating of projects evaluated

75. As can be seen in Table 11 below, the overall rating of completed projects used in the old project completion report format requested a qualitative assessment by the implementing agencies. The ratings for the 22 projects of the sample for which project completion reports are available in the old format vary between highly satisfactory, more than planned (3), satisfactory as planned (5), satisfactory, though not as planned (13), and unsatisfactory, less than planned (1). No project was declared as unacceptable. Over half of the projects were reported as satisfactory because in the end the goal of ODS solvent phase-out was achieved. However, "less than planned" status reflects the fact that implementation of most projects did not stay on schedule and/or had budget challenges.

Table 11: Overall assessment by Implementing Agencies as per old PCR

Agency	Categories by Implementing Agencies in PCR*					
	1	**2**	**3**	**4**	**5**	**Total**
IBRD	1	3	2	1		7
UNDP	2	0	2			4
UNIDO	0	2	9			11
Total	3	5	13	1	0	22

*1 - Highly satisfactory, more than planned
2 - Satisfactory, as planned
3 - Satisfactory, though not as planned
4 - Unsatisfactory, less than planned
5 - Unacceptable
*Excluding three subprojects in Egypt CEGY/SOL/18/INV/52

76. The results of applying the new overall assessment scheme for investment projects adopted at the 32nd Meeting of the Executive Committee are shown in Tables 12 and 13 below. It is difficult to compare it with the ratings by the Implementing Agencies. The scale is different (only three categories) and it has not been applied to all projects but only to those that had been completed according to Decision 28/2 of the Executive Committee (see Section VI above). In the Consultants' assessment it emerges that a higher share of projects turned out to be less satisfactory. Overall, the picture is less positive than in the self-assessment by the implementing agencies. However, one has to bear in mind that in the new rating, over half (16) of the projects are rated not applicable (N/A) because at least one of the conditions defined in Decision 28/2 was not fulfilled. In the previous rating scheme N/A was not an option.

Table 12: Overall assessment by Implementing agencies as per new PCR

Agency	Categories in Implementing Agencies in PCR			
	Highly Satisfactory	**Satisfactory**	**Less Satisfactory**	**Total**
IBRD				
UNDP	1	7		**8**
UNIDO				
Total	**1**	**7**		**8**

Table 13: Overall assesment by the Evaluators using the new Rating Scheme

Agency	Categories				
	Highly Satisfactory	**Satisfactory**	**Less Satisfactory**	**N/A**	**Total**
IBRD	2	1	1	**3**	**7**
UNDP	1	2	1	**8**	**12**
UNIDO	1	1	4	**5**	**11**
Total	**3**	**4**	**5**	**16**	**30**

XVII Project Documents, Technical Reviews and Project Completion Reports (PCR)

77. The formats used for the project documents, technical reviews and PCRs have improved over the years. Notably, the PCR now requires more accountability. However, this improvement has been offset by the poor quality of the completed forms of all types. Information

was often omitted, repetitive and inaccurate. Most troublesome was data copied verbatim from one project to the next whether it applied or not. Sometimes irrelevant project-specific or country-specific information was carried over to other projects or countries. It was difficult to find specific detail in the documents. It was not clear which document contained the right data and that in different documents was often contradictory, irrelevant, repetitive, opaque or absent. This was a major time-consuming exercise, particularly when trying to understand where, how or why changes took place. The Consultants estimate that these problems more than doubled the time required to elaborate their evaluation reports. The following discussion will address each type of paperwork and offer a suggestion to improve future solvent-project documentation.

(a) Project Documents:

78. The strength of the project documents reviewed was their financial annexes. Almost without exception, the project's estimated incremental capital and operating costs were well laid out and easy to follow, although the estimations were often at the high end. Errors were still found but, in general, these sections were well done.

79. The primary problem with the project documents for solvent projects was that the authors did not give a clear, traceable, story about how they arrived at the selected alternative. Instead of discussing cleaning requirements, possible alternatives and the method used for selection, the project documents contained marginally relevant information on company history and company product detail. The discussion about possible alternatives was typically either several pages of "waffling" from standard error-containing word-processed texts or nothing at all. This is probably because there are not just one or two alternatives possible but perhaps six separate processes, each with tens of specific products and machines. The documents should contain bullets of just one or two lines, each enumerating a process considered and why it was preferred or rejected. This would be followed by a similar consideration of half-a-dozen generic cleaning products and then by generic cleaning machines. This would allow others to follow the thought processes behind a selection, often seemingly arbitrary now. When a generic product (e.g., a buffered alkaline detergent) is chosen, as opposed to a generic chemical compound (e.g., trichloroethylene), the trade name of a suitable product should be identified (e.g., XLKlene 5, from John Doe Inc.) and that of a second source, because commercial products do not always remain available or stable in composition. Reliance on a single product can be dangerous. Concerning the bidding process for cleaning machines, care should be taken that companies from the same country and region are not excluded.

(b) Technical Reviews

80. The true value of the technical review may not be obvious. It should point out issues with the project document before project approval. Apparently technical reviews are used now in an iterative discussion between the expert who prepares the project document and the reviewer to improve the draft project document, a process which remains invisible for outsiders and results in a conformity of views expressed and solutions proposed. This may explain why, in all but one case, the technical reviews appeared to be a "rubber stamp" formality. Nonetheless, there were several cases where an expert should have recognised glaring problems with the project document. The consultants feel that the original intent of the technical review may be diminished. Possibly, this could be because the same one or two experts were used for

the preparation and the reviews of all project documents within a country. Use of several different experts may create a more competitive atmosphere and in turn a better product

(c) Project Completion Reports

81. As previously mentioned, the PCR is the most improved of all of the current set of project documents. However, not one single evaluated project had the PCR filled in correctly and completely. In addition to making post-implementation evaluations difficult, this lack of data on product consumption, operating cost/savings, and production quality makes the transfer of lessons learned to future projects impossible.

82. The other noteworthy practice seen in the PCRs was copying of planning data from the project documents as if it were the actual results experienced. In spite of the frequent difficulties to obtain accurate data from the beneficiary enterprises, simple cut and paste completion of the PCR should never be acceptable.

83. It is recommended that, as authorised in Decision 32/18, paragraph d, the Implementing Agencies withhold where possible part of funding until such time as proof of equipment destruction has been provided and the company has also submitted to the implementing agency the necessary data to prepare a project completion report of good quality.

(d) Suggested Project Paperwork Alternative

84. In order to alleviate the above problems, current documents could be modified to simplify the procedure, while retaining the essential format. For example, having a single electronic form, divided into sections, may do this. Sections would consist of the current set of individual documents: Project Document, Technical Review, Project Approval and Project Completion Report. Each section, including iterations and technology changes, would be filled in when appropriate. If necessary, changes could be added with a change record made for all the modifications introduced throughout the document at one particular time. This would eliminate the numerous repetitions required for separate forms. At the same time, the whole history of a project would become transparent.

85. The resulting data base should contain information on a) the types and make of equipment, b) the throughput and size of the parts; c) the generic and trade names of any products used; d) the real ICC and IOCs; e) the degree of success of the project and technical problems encountered. The data base could be placed on a Website and be accessible via password to all authorized stakeholders.

XVIII Lessons learnt

86. When conditions are imposed for approval, beneficiaries, IAs and NOUs should ensure that the conditions are met. At least three projects, ignored the conditions, each for different reasons.

87. Larger companies have sufficient internal resources and know-how to help substantially in the preparation and implementation of a project. In some cases, it was evident that they were more knowledgeable than the sector expert in their specific sub-sector. It must never be forgotten that the solvents sector has many very specialised sub-sectors and an expert in one is not necessarily competent in another. Problem arise when the technical competence of both the beneficiary and the expert is lacking.

88. The sheer numbers of remaining users is undoubtedly the largest challenge to monitoring the remaining consumption. For several reasons, most of the MLF investment project effort over the last 10 years has been with large- and medium-sized enterprises. The focus for the next 10 years will have to shift to the medium and small users. Even with the small number of projects (companies) monitored today, the level of monitoring seems inadequate. To say that the average number of visits to a beneficiary by the NOU or its agencies was two for the life of a project is probably high. The NOUs simply do not have the manpower to monitor even the identified ODS solvent users adequately. Moving to the small enterprise level will only make matters more difficult. Identification and monitoring of the SMEs has long been recognised as a phase-out challenge, especially in the solvents sector.

89. In three sub-projects within an umbrella project, the proprietary solvent recommended by the implementing agency expert became difficult to obtain and the cost more than tripled. In one enterprise, the equipment was also unused for over 4 months while waiting for a new supply of solvent. In all cases where a proprietary product is used, a back-up solvent must always be tested and identified to ensure continuity of production at an acceptable cost in the event of a supply breakdown.

XIX Main Recommendations

90. Most recommendations contained in the various sections of this report are addressed to the Secretariat, the implementing agencies, the national ozone units and the beneficiary companies. They relate to application of existing decisions and improvements of working modalities. The Executive Committee might wish to take note of the report and consider the following recommendations:

(a) that invoices for the purchase of ODS solvents by beneficiary enterprises should, as much as possible, be certified by the National Ozone Unit and should be kept there and in the enterprise on record for future verification;

(b) that the implementing agencies include for all baseline equipment model and serial numbers or some other positive identification, in both the project document and the PCR, in order to ensure correlation;

(c) that implementing agencies report in the PCR savings arising from buying less costly equipment and/or realizing lower incremental operating cost or higher incremental operating savings than anticipated and approved, and return a pro-rata amount corresponding to the share of grant funding in the total eligible incremental cost to the Multilateral Fund.

Annex I: Overall Rating of Solvent Project Evaluated

Country	Code	Project Title	Agency	ODP To Be Phased Out As Per Inventory	ODP Phased Out As Per PCR	ODP Phased Out As Per Evaluation	Difference of ODP Phased Out/ Planned and Achieved As Per Evaluation	ODP Points	ODS-free Production Points	Equipment Destruction Points	Approved Date of Completion	Revised Completion Date As Per Progress Report	Actual Date of Completion As Per Progress Report	Actual Date of Completion As per Evaluation	Delay in Implementation (months)	Delays Points
Brazil	BRA/SOL/18/INV/36	DMG Equipamentos Medicos Ltda.	UNDP	2.00	2.00	2.00	0	20	20	0	Nov-96		Nov-97	Nov-97	12.17	0
Brazil	BRA/SOL/18/INV/37	Brasimet Comercio e Industria	UNDP	1.60	1.60	1.60	0	20	20	20	Nov-96		Dec-99	May-99	30.37	-15
Brazil	BRA/SOL/18/INV/39	Elgin Maquinas	UNIDO	6.00	6.00	6.00	0	20	20	20	Feb-97		Nov-97	Jun-98	16.17	-15
Brazil	BRA/SOL/20/INV/61	Tapmatic	UNIDO	9.90	9.90	9.90	0	20	20	0	Oct-97		Dec-97	Dec-98	14.20	-15
China	CPR/SOL/12/INV/65	Phasing out ODS consuming solvents across China	UNDP	0.00	0.00	0.00	0	N/A	N/A	N/A	Mar-96		Nov-99	Nov-99	44.67	-15
China	CPR/SOL/19/INV/169	Shanghai Sixth Radio Factory	UNDP	16.40	16.40	15.37	-1.03	20	20	0	Apr-98	May-98	Ongoing	Aug-01	39.60	-15
China	CPR/SOL/19/INV/172	Baoshi Electronics Corporation	UNDP	7.40	7.40	7.40	0	20	20	20	Apr-98	May-98	Jul-00	Jul-00	26.40	-15
China	CPR/SOL/20/INV/178	Shanghai Automation Instrumentation Factory	UNDP	16.00	16.10	15.13	-0.87	20	20	0	Sep-98	Oct-98	Ongoing	Mar-01	29.40	-15
China	CPR/SOL/20/INV/186	Shanghai No 8 Radio Factory	UNDP	19.20	19.20	19.20	0	20	0	20	Sep-98	Oct-98	Ongoing	Mar-01	29.40	-15
China	CPR/SOL/22/INV/195	Shanghai Railway Communication Equipment Factory	UNDP	14.40	14.40	14.40	0	20	20	20	Jun-99		Ongoing	Mar-01	21.30	-15
China	CPR/SOL/22/INV/212	Hangli Refrigeration Ltd.	UNIDO	28.80	28.80	28.80	0	20	20	0	Dec-98		Dec-99	Dec-99	12.17	0
China	CPR/SOL/22/INV/213	Huangshi Dongbei Refrigeration Co.	UNIDO	37.60	37.60	37.60	0	20	20	20	Dec-98		Dec-98	Dec-98	0.00	15
Egypt	EGY/SOL/18/INV/52	Three Electronic companies	UNIDO	13.70	13.68	13.70	0	20	20	N/A	Nov-96		Oct-98	Oct-98	23.30	-15
Egypt	EGY/SOL/18/INV/52 Subproject 1	Behna	UNIDO			6.56		20	20	20	Nov-96		Oct-98	Oct-98	23.30	-15
Egypt	EGY/SOL/18/INV/52 Subproject 2	AIO Electronics	UNIDO			3.04		20	20	20	Nov-96		Oct-98	Oct-98	23.30	-15
Egypt	EGY/SOL/18/INV/52 Subproject 3	Sakr	UNIDO			3.20		20	20	0	Nov-96		Oct-98	Oct-98	23.30	-15
Egypt	EGY/SOL/18/INV/53	Arab International Optronics	UNIDO	2.10	2.10	2.10	0	20	0	0	Nov-96		Dec-99	Dec-99	37.50	-15
Egypt	EGY/SOL/19/INV/54	Siltal	UNIDO	2.00	2.00	2.00	0	20	20	20	Jun-96		Oct-98	Oct-98	28.40	-15
Egypt	EGY/SOL/19/INV/56	Technopol	UNIDO	6.00	6.00	6.00	0	20	20	20	May-97		Dec-98	Nov-98	18.30	-15
Egypt	EGY/SOL/19/INV/57	Abbasol	UNIDO	8.00	8.00	8.00	0	20	20	20	May-97		Dec-98	Dec-98	19.30	-15
India	IND/SOL/13/INV/26	Hindustan Syringes and Medical Devices Private Ltd., Haryana	IBRD	53.20	118.00	118.00	64.80	20	N/A	N/A	Jul-95	Dec-96	Dec-96	Dec-96	0.00	15
India	IND/SOL/18/INV/65	Electronic Research Ltd. (ERL-Bangalore)	UNIDO	16.35	16.35	16.35	0	20	20	0	May-97		Dec-98	Dec-98	19.30	-15
India	IND/SOL/19/INV/95	Indian Telephone Industries Ltd. (ITI, Bangalore)	UNIDO	6.97	6.97	6.97	0	20	0	20	Nov-97		Dec-96	Dec-97	1.00	15
Malaysia	MAL/SOL/11/INV/18	Ngai Cheong Metal Industries	UNDP	2.00	2.30	2.30	0.30	20	20	0	Nov-94		Apr-95	Apr-95	5.03	15
Malaysia	MAL/SOL/12/INV/35	Perusahaan Otomobil National Bhd. (Proton)	UNDP	20.00	19.50	19.50	-0.50	20	20	0	Dec-95		Apr-95	Apr-95	-8.13	15
Malaysia	MAL/SOL/18/INV/81	Widetech	IBRD	29.00	29.00	29.00	0	20	20	20	Nov-96	Jul-97	Dec-97	Dec-97	5.10	15
Malaysia	MAL/SOL/18/INV/82	Eng Teknologi Sdn. Bhd.	IBRD	3.36	3.36	3.36	0	20	20	0	Nov-96	Apr-97	Sep-98	Sep-98	17.27	-15
Philippines	PHI/SOL/09/INV/13	Electronic Assemblies, Inc.	IBRD	3.84	3.84	3.84	0	20	20	20	Sep-93	Feb-97	Feb-97	Feb-97	0.00	15

Country	Code	Project Title	Agency	ODP To Be Phased Out As Per Inventory	ODP Phased Out As Per PCR	ODP Phased Out As Per Evaluation	Difference of ODP Phased Out/ Planned and Achieved As Per Evaluation	ODP Points	ODS-free Production Points	Equipment Destruction Points	Approved Date of Completion	Revised Completion Date As Per Progress Report	Actual Date of Completion As Per Progress Report	Actual Date of Completion As per Evaluation	Delay in Implementation (months)	Delays Points
Philippines	PHI/SOL/19/INV/46	Multiple corporations that manufacture special formulations for various industrial markets	UNDP	53.60	43.80	54.00	0.40	20	20	0	Nov-97		Jun-98	Jun-98	7.07	0
Philippines	PHI/SOL/25/INV/56	Multiple corporations that manufacture special formulations for industrial markets (Ariad Industrial Co., Cloisonne, Redisol, Rodler)	UNDP	18.40	14.60	18.00	-0.40	20	20	20	Feb-00		Dec-99	Dec-99	-2.07	15
Thailand	THA/SOL/10/INV/15	Thai Heat Exchange Co. Ltd.	IBRD	11.00	11.13	11.13	0.13	20	20	20	Mar-94	Aug-97	Aug-98	Mar-98	7.07	0
Thailand	THA/SOL/13/INV/34	Team Tronics, Co. Ltd.	IBRD	12.00	11.52	11.52	-0.48	20	20	20	Jan-95	Dec-97	Aug-99	Jan-99	13.20	-15
Thailand	THA/SOL/15/INV/40	Thai Airways	IBRD	6.00	0.80	0.80	-5.20	0	20	0	Jun-96	Dec-97	Dec-99	Oct-99	22.30	-15

Country	Code	Project Title	Agency	Approved Cost-Effectiveness Planned As Per Inventory (US$/kg)	Actual Cost-Effectiveness As Per PCR (US$/kg)	Cost-Effectiveness As Per Evaluation (US$/kg)****	Cost-Effectiveness Points	Funds Approved As Per Inventory	Funds Disbursed As Per Progress Report 2000	Funds Disbursed As Per PCR	Difference Inventory and Progress	Project Financially Closed	Funds Returned to the MLF	Qualitative Points	Rating by IA in Old PCRs *	Rating by IA in New PCRs **	Total Points in PER	New Rating in PER ***
Brazil	BRA/SOL/18/INV/36	DMG Equipamentos Medicos Ltda.	UNDP	19.00	19.00	18.99	0	38,000	37,994	37,994	6	X	6	40		1	N/A	N/A
Brazil	BRA/SOL/18/INV/37	Brasimet Comercio e Industria	UNDP	19.00	19.00	19.00	0	30,400	30,400	30,400	0		0	40		2	85	2
Brazil	BRA/SOL/18/INV/39	Elgin Maquinas	UNIDO	26.09	24.78	24.80	0	156,567	150,279	148,779	6,288	X	0	40	3		85	2
Brazil	BRA/SOL/20/INV/61	Tapmatic	UNIDO	19.60	17.06	17.06	5	194,500	163,650	168,899	30,850		0	38	3		N/A	N/A
China	CPR/SOL/12/INV/65	Phasing out ODS consuming solvents across China	UNDP	N/A	N/A	N/A	N/A	524,734	462,027	474,027	62,707		0	35		2	N/A	N/A
China	CPR/SOL/19/INV/169	Shanghai Sixth Radio Factory	UNDP	10.40	7.24	7.73	5	138,400	82,430	118,785	55,970		0	24		2	N/A	N/A
China	CPR/SOL/19/INV/172	Baoshi Electronics Corporation	UNDP	38.50	37.51	37.51	0	284,900	248,311	277,574	36,589		0	32		2	77	2
China	CPR/SOL/20/INV/178	Shanghai Automation Instrumentation Factory	UNDP	20.20	19.53	20.78	-5	325,000	268,687	314,440	56,313		0	26		2	N/A	N/A
China	CPR/SOL/20/INV/186	Shanghai No 8 Radio Factory	UNDP	19.70	16.05	16.05	5	378,000	204,893	308,199	173,107		0	18		2	N/A	N/A
China	CPR/SOL/22/INV/195	Shanghai Railway Communication Equipment Factory	UNDP	19.19	19.19	19.19	0	276,287	251,755	276,287	24,532		0	24		2	69	3
China	CPR/SOL/22/INV/212	Hangli Refrigeration Ltd.	UNIDO	7.56	7.56	7.56	0	217,762	217,700	217,700	62		62	28	3		68	3
China	CPR/SOL/22/INV/213	Huangshi Dongbei Refrigeration Co.	UNIDO	6.28	6.28	6.28	0	236,242	236,242	236,242	0	X	0	38	2		113	1

Country	Code	Project Title	Agency	Approved Cost-Effectiveness Planned As Per Inventory (US$/kg)	Actual Cost-Effectiveness As Per PCR (US$/kg)	Cost-Effectiveness As Per Evaluation (US$/kg)****	Cost-Effectiveness Points	Funds Approved As Per Inventory	Funds Disbursed As Per Progress Report 2000	Funds Disbursed As Per PCR	Difference Inventory and Progress	Project Financially Closed	Funds Returned to the MLF	Qualitative Points	Rating by IA in Old PCRs *	Rating by IA in New PCRs **	Total Points in PER	New Rating in PER ***
Egypt	EGY/SOL/18/INV/52	Three Electronic companies	UNIDO	16.58	16.60	16.58	0	227,203	227,203	227,203	0	X	0	N/A	3		N/A	N/A
Egypt	EGY/SOL/18/INV/52 Subproject 1	Behna	UNIDO			13.56	0							18			63	3
Egypt	EGY/SOL/18/INV/52 Subproject 2	AIO Electronics	UNIDO			22.70	-5							18			58	3
Egypt	EGY/SOL/18/INV/52 Subproject 3	Sakr	UNIDO			21.56	-5							10			N/A	N/A
Egypt	EGY/SOL/18/INV/53	Arab International Optronics	UNIDO	24.27	23.16	24.27	0	48,533	48,533	48,628	0	X	0	24	3		N/A	N/A
Egypt	EGY/SOL/19/INV/54	Siltal	UNIDO	24.39	24.39	24.39	0	48,784	48,288	48,784	496	X	496	12	3		57	3
Egypt	EGY/SOL/19/INV/56	Technopol	UNIDO	20.87	20.87	20.87	0	125,249	125,249	125,249	0	X	0	10	3		55	3
Egypt	EGY/SOL/19/INV/57	Abbasol	UNIDO	19.32	19.32	19.32	0	154,544	154,544	154,544	0	X	0	24	3		69	3
India	IND/SOL/13/INV/26	Hindustan Syringes and Medical Devices Private Ltd., Haryana	IBRD	9.62	2.76	3.89	5	481,000	458,702	459,738	22,298	X	22,298	N/A	2		N/A	N/A
India	IND/SOL/18/INV/65	Electronic Research Ltd. (ERL-Bangalore)	UNIDO	12.03	11.54	11.67	0	192,421	190,220	190,843	2,201	X	2,201	20	3		N/A	N/A
India	IND/SOL/19/INV/95	Indian Telephone Industries Ltd. (ITI, Bangalore)	UNIDO	15.48	15.24	15.24	0	107,954	106,976	106,248	978	X	0	32	2		N/A	N/A
Malaysia	MAL/SOL/11/INV/18	Ngai Cheong Metal Industries	UNDP	31.74	23.90	23.90	5	63,480	63,480	54,984	0	X	0	32	3		N/A	N/A
Malaysia	MAL/SOL/12/INV/35	Perusahaan Otomobil National Bhd. (Proton)	UNDP	35.02	32.90	32.88	5	700,439	641,095	641,095	59,344	X	59,344	36	1		N/A	N/A
Malaysia	MAL/SOL/18/INV/81	Widetech	IBRD	13.74	13.71	13.74	0	398,418	398,418	397,666	0	X	0	30	2		105	1
Malaysia	MAL/SOL/18/INV/82	Eng Teknologi Sdn. Bhd.	IBRD	34.93	34.90	34.93	0	117,379	117,379	117,379	0	X	0	34	3		N/A	N/A
Philippines	PHI/SOL/09/INV/13	Electronic Assemblies, Inc.	IBRD	176.00	184.43	176.00	0	710,000	675,859	708,208	34,141	X	34,141	30	1		105	1

Country	Code	Project Title	Agency	Approved Cost-Effectiveness Planned As Per Inventory (US$/kg)	Actual Cost-Effectiveness As Per PCR (US$/kg)	Cost-Effectiveness As Per Evaluation (US$/kg)****	Cost-Effectiveness Points	Funds Approved As Per Inventory	Funds Disbursed As Per Progress Report 2000	Funds Disbursed As Per PCR	Difference Inventory and Progress	Project Financially Closed	Funds Returned to the MLF	Qualitative Points	Rating by IA in Old PCRs *	Rating by IA in New PCRs **	Total Points in PER	New Rating in PER ***
Philippines	PHI/SOL/19/INV/46	Multiple corporations that manufacture special formulations for various industrial markets	UNDP	11.99	11.53	9.36	5	642,800	461,132	505,278	181,668		0	8	3		N/A	N/A
Philippines	PHI/SOL/25/INV/56	Multiple corporations that manufacture special formulations for industrial markets (Ariad Industrial Co., Cloisonne, Redisol, Rodler)	UNDP	18.20	17.30	14.07	5	334,600	80,864	253,205	253,736		0	26	1		114	1
Thailand	THA/SOL/10/INV/15	Thai Heat Exchange Co. Ltd.	IBRD	24.36	22.21	22.15	5	254,000	254,000	246,573	0	X	0	34	3		99	2
Thailand	THA/SOL/13/INV/34	Team Tronics, Co. Ltd.	IBRD	18.48	18.69	18.69	-5	221,760	221,760	215,300	0	X	0	32	2		72	3
Thailand	THA/SOL/15/INV/40	Thai Airways	IBRD	77.32	508.45	508.45	-5	463,900	431,300	406,758	32,600	X	32,600	38	4		N/A	N/A

Country	Code	Project Title	Agency	Quality of project design	Conversion Technology	Type of equipment	Supplier	Safety/health protection	Capacity for maintenance of equipment	Product quality maintained	Provisions made to prevent return to ODS use
Brazil	BRA/SOL/18/INV/36	DMG Equipamentos Medicos Ltda.	UNDP	5	5	5	5	5	5	5	5
Brazil	BRA/SOL/18/INV/37	Brasimet Comercio e Industria	UNDP	5	5	5	5	5	5	5	5
Brazil	BRA/SOL/18/INV/39	Elgin Maquinas	UNIDO	5	5	5	5	5	5	5	5
Brazil	BRA/SOL/20/INV/61	Tapmatic	UNIDO	5	5	5	5	3	5	5	5
China	CPR/SOL/12/INV/65	Phasing out ODS consuming solvents across China	UNDP	5	5	5	5	5	5	5	N/A
China	CPR/SOL/19/INV/169	Shanghai Sixth Radio Factory	UNDP	1	3	3	3	3	5	5	1
China	CPR/SOL/19/INV/172	Baoshi Electronics Corporation	UNDP	5	3	5	5	1	3	5	5
China	CPR/SOL/20/INV/178	Shanghai Automation Instrumentation Factory	UNDP	1	1	3	5	1	5	5	5
China	CPR/SOL/20/INV/186	Shanghai No 8 Radio Factory	UNDP	1	1	1	1	3	5	5	1
China	CPR/SOL/22/INV/195	Shanghai Railway Communication Equipment Factory	UNDP	3	1	1	3	1	5	5	5
China	CPR/SOL/22/INV/212	Hangli Refrigeration Ltd.	UNIDO	5	5	5	5	1	1	3	3
China	CPR/SOL/22/INV/213	Huangshi Dongbei Refrigeration Co.	UNIDO	5	5	5	5	3	5	5	5
Egypt	EGY/SOL/18/INV/52	Three Electronic companies	UNIDO	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Egypt	EGY/SOL/18/INV/52 Subproject 1	Behna	UNIDO	1	1	3	1	1	5	1	5
Egypt	EGY/SOL/18/INV/52 Subproject 2	AIO Electronics	UNIDO	1	1	3	1	3	3	1	5
Egypt	EGY/SOL/18/INV/52 Subproject 3	Sakr	UNIDO	1	1	3	1	1	1	1	1
Egypt	EGY/SOL/18/INV/53	Arab International Optronics	UNIDO	1	1	1	5	3	5	5	3
Egypt	EGY/SOL/19/INV/54	Siltal	UNIDO	1	1	1	1	1	1	1	5
Egypt	EGY/SOL/19/INV/56	Technopol	UNIDO	1	1	1	1	-1	1	3	3
Egypt	EGY/SOL/19/INV/57	Abbasol	UNIDO	3	3	3	3	1	1	5	5
India	IND/SOL/13/INV/26	Hindustan Syringes and Medical Devices Private Ltd., Haryana	IBRD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
India	IND/SOL/18/INV/65	Electronic Research Ltd. (ERL-Bangalore)	UNIDO	1	3	3	1	3	1	5	3
India	IND/SOL/19/INV/95	Indian Telephone Industries Ltd. (ITI, Bangalore)	UNIDO	3	3	3	5	3	5	5	5
Malaysia	MAL/SOL/11/INV/18	Ngai Cheong Metal Industries	UNDP	5	5	5	3	3	3	5	3
Malaysia	MAL/SOL/12/INV/35	Perusahaan Otomobil National Bhd. (Proton)	UNDP	5	5	5	3	3	5	5	5
Malaysia	MAL/SOL/18/INV/81	Widetech	IBRD	5	5	5	5	1	1	5	3
Malaysia	MAL/SOL/18/INV/82	Eng Teknologi Sdn. Bhd.	IBRD	5	5	5	3	3	3	5	5
Philippines	PHI/SOL/09/INV/13	Electronic Assemblies, Inc.	IBRD	3	5	3	3	3	5	3	5
Philippines	PHI/SOL/19/INV/46	Multiple corporations that manufacture special formulations for various industrial markets	UNDP	1	1	1	1	1	1	1	1
Philippines	PHI/SOL/25/INV/56	Multiple corporations that manufacture special formulations for industrial markets (Ariad Industrial Co., Cloisonne, Redisol, Rodler)	UNDP	5	5	1	3	1	3	5	3
Thailand	THA/SOL/10/INV/15	Thai Heat Exchange Co. Ltd.	IBRD	5	5	5	3	3	3	5	5
Thailand	THA/SOL/13/INV/34	Team Tronics, Co. Ltd.	IBRD	3	5	5	3	5	3	3	5
Thailand	THA/SOL/15/INV/40	Thai Airways	IBRD	5	5	5	3	5	5	5	5

* Overall assessment by Implementing Agencies as pe Old PCR

1 - Highly satisfactory, more than planned
2 - Satisfactory, as planned
3 - Satisfactory, though not as planned
4 - Unsatisfactory, less than planned
5- Unacceptable

** Overall rating by Implementing Agencies as per New PCR

1 - Highly satisfactory: 100 to 120
2 - Satisfactory: 75 to 99
3 - Less satisfactory: 48 to 74

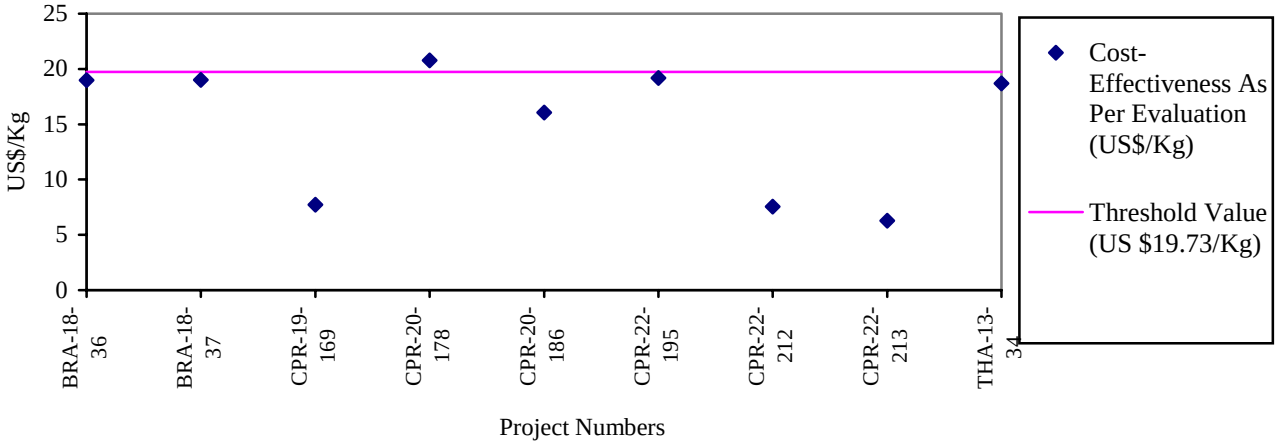
*** Overall rating as per PER

1 - Highly satisfactory: 100 to 120
2 - Satisfactory: 75 to 99
3 - Less satisfactory: 48 to 74

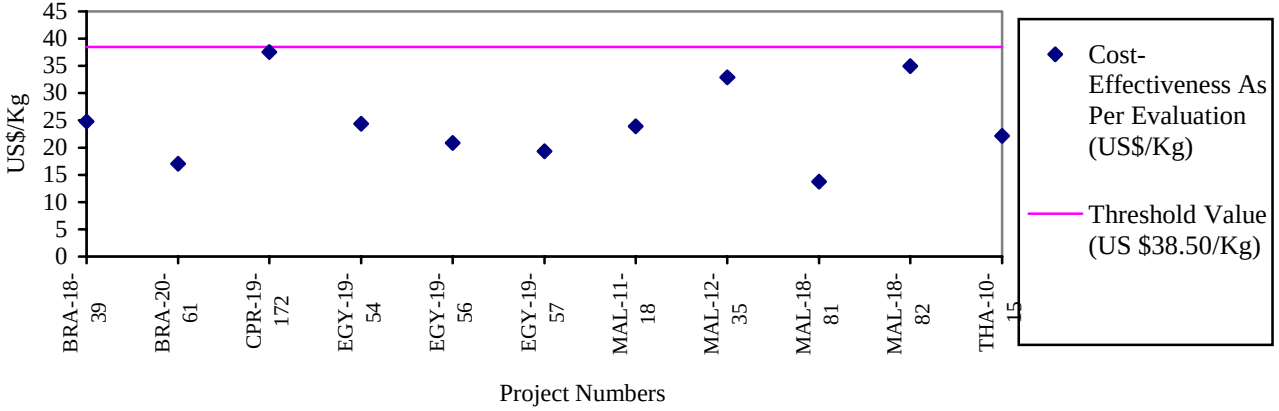
**** Cost Effectiveness As Per Evaluation = ODP Phased Out As Per Evaluation/Funds Disbursed As Per Progress Report/1000
Note: Some disbursed figures are provisional data

Annex II: Cost-Effectiveness for Solvent Projects Evaluated by Subsector

CFC-113



TCA



*Cost-Effectiveness Threshold values apply only for projects approved after the 16th EXCOM Meeting.

** For CFC-113, excludes one evaluated project (PHI/SOL/09/INV/13) that was approved before 16th EXCOM Meeting with cost-effectiveness of US$/kg 176.00