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Executive Committee of
the Multilateral Fund for the
Implementation of the Montreal Protocol

Fifteenth Meeting
Montreal, 13-16 December 1994

PROJECT PROPOSALS: INDONESIA

This document includes the following project proposals and the Fund Secretariat's Comments and Recommendations. The project proposals have been grouped by project sector. The agency responsible for the implementation of the project is also indicated. The project proposals are presented in the order indicated below. The Fund Secretariat's Comments and Recommendations are presented at the front of the document.

Foam

- Elimination of CFC-11 in the manufacture of polyurethane foam sheet at Musimassejahtera Abadi	IBRD
- Elimination of CFC-11 in the manufacture of polyurethane foam sheet at Positive Foam Industry	IBRD
- Elimination of CFC-11 in the manufacture of polyurethane foam sheet at Multi Karya Makmur	IBRD
- Elimination of CFC-12 in the manufacture of extruded polyethylene and polystyrene foam sheet at PT Inter Foamindosentra	IBRD

Halon

- Elimination in production of halon 1211 fire protection extinguishers at Dahlia Cahaya, Bayu Sentosa Agung and Chubb Lips, Indonesia	IBRD

Refrigeration

- Elimination of ODS used in the production of household refrigerators at P.T. Lippo Melco Manufacturing	IBRD
- Elimination of ODS used in the manufacturing of household refrigerators at PT. Sanyo Industries Indonesia, Jakarta	IBRD
- Elimination of ODS used in the production of household refrigerators at P.T. Sharp Yasonta, Indonesia	IBRD
- Reducion of CFC-12 emission during service of MACs by use of recycling equipment	IBRD

Solvent

- Conversion of metal cleaning processes from 1,1,1-trichloroethane (TCA) to aqueous cleaning at PT.INTI	IBRD
- Conversion of metal cleaning processes from 1,1,1-trichloroethane (TCA) to aqueous cleaning at PT. Markindo Theco	IBRD
- Elimination of the use of 111 TCA and CFC-113 in the manufacture of metal and plastic motorcycle parts at PT KGD Indonesia, Inc.	UNDP
- Elimination of the use of 111 TCA in the manufacture of nickel plated steel and brass AA battery parts at PT FDK-Intercallin	UNDP
- Elimination of the use of CFC-113 in the manufacture of metal personal headphone parts at PT Padma Pacific Sejahtera	UNDP

PROJECT EVALUATION SHEET

COUNTRY OR REGION:	Indonesia
PROJECT TITLE:	(i) Investment project to phaseout CFC-11 at: a) Musimassejahtera Abadi b) Positive Foam Industry c) Multi Karya Makmur (ii) Investment project to phase-out CFC-12 at PT Inter Foamindosentra
TOTAL BUDGET:	US $1,569,900(See attached Table)
INCREMENTAL COSTS:	(i) a) US $390,000 b) US $123,700 c) US $449,000 (ii) US $390,000
ODS PHASE-OUT:	(i) a) 120 tonnes CFC-11 b) 200 tonnes CFC-11 c) 90 tonnes CFC-11 (ii) 120 tonnes CFC-12
COST EFFECTIVENESS[1]:	(i) a) US $0.365/kg b) US $0.69/kg c) US $0.263/kg (ii) US $0.15/kg
PROJECT DURATION:	1 year
IMPLEMENTING AGENCY:	World Bank
NATIONAL COORDINATING AGENCY:	Ministry of Environment
TECHNICAL REVIEW COMPLETED:	YES _X_ NO _

1 Determined as the ratio of incremental costs to the estimated annual saving of ODP ($\$/ODP_{Kg}$).

PROJECT COSTS				
Project Cost	Musimassejahtera Abadi	Multi Karya makmur	Positive Foam	Inter Foamindosentra
Capital Cost (US $)	341,075	357,950	617,950	850,000
Operational Cost/Savings (US $)	1,175	(240,550)	(222,950)	(379,300)
Sub-total	342,250	117,400	395,000	470,700
15% Contingency	51,338	17,610	59,250	70,605
Financial Agent Fee	11,800	4,000	13,650	16,300
TOTAL	405,388	139,010	467,900	557,605

SECRETARIAT'S COMMENTS

1. This batch of three flexible polyurethane foam projects brings to seven the total number of projects to phase out ODS in the flexible foam sub-sector in Indonesia, reported to consist of about 12 major enterprises. In addition to this an umbrella project to phase-out ODS in small flexible foam enterprises has also been approved for the World Bank.

2. The three enterprises will phase-out CFC-11 using methylene chloride. The costs associated with the conversion relate to measures to ensure occupational health and safety. In these projects, as in others, the quality of the methylene chloride used calls for preventive measures against scorching during production of low density foam, i.e. provision of vacuum cooling systems. This accounts for a significant portion (50-57 per cent) of the capital costs.

3. The total requested grant amounted to US $1,012,400. After discussion of some of the cost items with the World Bank, particularly fire safety components, the agreed incremental costs amounted to a total of US $962,000 for the three enterprises.

4. Among the large foam companies, six are reported to be producing extruded polystyrene and polyethylene foam. At the Eleventh Meeting, two projects were approved in this subsector for the World Bank. One project was to phase-out CFC-12 through the use of HCFC-22, while the other (PT Intitri Muliatama) was to phase-out the CFC-12 through the use of a Dow Chemical proprietary technology which employs 100 per cent carbon dioxide in the production of extruded polystyrene foam. This latter project was to serve as demonstration for other enterprises. However it is reported that the proprietary technology will not be made available to this Inter Foamindosentra project or any future project in the country.

5. The company has arranged to acquire a technology from Sencorp Systems Inc. (of USA) which employs a mixture of CO_2 and butane leading to 100% CO_2 substitution for polystyrene foam production after a period of time and some experience with the technology.

6. The Technical Reviewer endorsed the technology. Following discussion on the local prices of the relevant chemicals, it was agreed to adjust the price of CO_2 (from US $0.70/kg to US $0.50/kg). The agreed incremental cost consequently amounted to US $390,000.

SECRETARIAT'S RECOMMENDATION

7. The Fund Secretariat recommends approval and funding of the projects as follows:

Musimassejahtera Abadi:	US $390,000
Multi Karya Makmur:	US $123,700
Positive Foam:	US $449,000
Inter Foamindosentra:	US $390,000

8. The World Bank should formally report to the Executive Committee on the issue of the transfer of the proprietary technology to PT Intitri Muliatama and how the Government of Indonesia intends to proceed with that project.

PROJECT EVALUATION SHEET

COUNTRY OR REGION:	Indonesia	
PROJECT TITLE:	Elimination in Production of halon 1211 Fire Protection Extinguishers	
BUDGET:	Capital Costs: Operating Savings:	US $895,700 (US $141,800)
INCREMENTAL COSTS:	US $753,300	
ODS PHASE-OUT:	155 MT halon 1211 per year (465 ODP MT)	
COST EFFECTIVENESS:	US $1.62 per kg ODP saved	
PROJECT DURATION:	1 year	
IMPLEMENTING AGENCY:	World Bank	
NATIONAL COORDINATING AGENCY:	State Ministry of the Environment	
TECHNICAL REVIEW COMPLETED:	YES _X_ NO _	

SECRETARIAT'S COMMENTS

1. This project will phase out the use of halon 1211 in all fire equipment manufacturing in Indonesia by eliminating halon 1211 extinguisher manufacturers.

2. The producers of halon 1211 extinguishers are: CV. Dahlia Cahaya, PT. Bayu Sentosa Agung and PT. Chubb Lips Indonesia (49 per cent foreign ownership). The three companies consume about 155 MT of halon 1211 annually. They, however, produce extinguishers filled with ABC powder or with carbon dioxide albeit in much smaller number than those filled with halon 1211. The Country Programme of Indonesia, however, lists five extinguisher manufacturers in Indonesia.

3. Capital costs are requested for the purchase of new equipment, modification of some existing equipment and for training. However, most of the requested equipment are standard equipment not required by the conversion from halon 1211.

4. Operating savings are calculated on the basis of the differences in production costs of halon 1211 extinguishers and ABC powder or carbon dioxide extinguishers. However, the projected ratio of conversion is 50 per cent ABC powder and 50 per cent carbon dioxide filled extinguishers instead of the accepted 90%:10%.

5. Operating savings should be recalculated to take into consideration a more realistic ratio for ABC powder/carbon dioxide extinguishers, which will increase the savings.

6. The Secretariat is currently discussing with the World Bank the incremental costs of the project. The result of the discussion will be reported to the Project Review Sub-Committee.

SECRETARIAT'S RECOMMENDATION

Pending.

PROJECT EVALUATION SHEET

COUNTRY OR REGION:	Indonesia
PROJECT TITLE:	Elimination of Ozone Depleting Substances used in the production of Household Refrigerators at PT Lippo Melco Manufacturing
BUDGET:	Capital Costs US $889,000 Operating Costs US $283,000
INCREMENTAL COSTS:	US $738,000[1]
ODS PHASE-OUT:	13.19 MT of CFC-12
COST EFFECTIVENESS:	US $56.38 per Kg. ODP saved
PROJECT DURATION:	4 years
IMPLEMENTING AGENCY:	World Bank
NATIONAL COORDINATING AGENCY :	Indonesia State Ministry of Environment
TECHNICAL REVIEW COMPLETED:	YES _X_ NO _

SECRETARIAT'S COMMENTS

1. In this project PT Lippo Melco Manufacturing will eliminate the use of 13.09 MT of CFC-12 in refrigeration circuit of household refrigerators by converting to HFC-134a refrigerant. The elimination of ODSs in rigid insulation foam will be submitted in another project proposal at a later stage.

2. Capital costs are requested to provide for engineering assistance, training, testing, procurement and installation of equipment for mass production of new refrigerators with HFC-134a refrigerant.

3. The company is a subsidiary of Matsushita, Japan with 52.73 per cent of local ownership. Matsushita, Japan will provide necessary assistance in model development and testing.

4. Operating costs are calculated for a six months duration based on actual production of 47,000 units per year.

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1 Adjusted to reflect the local ownership of 52.73 per cent.

5. Costs associated with model development testing and training are calculated to be US $625,500 which represents 70 per cent of all costs of conversion. It substantially exceeds the same category of costs in similar conversion projects approved by the Executive Committee.

6. Some cost items have been identified by the Secretariat as not eligible incremental costs.

7. Some costs associated with equipment items are significantly higher than competitive prices for same type of equipment.

8. A portion of operating costs was not recognized as eligible incremental costs.

9. The Secretariat extensively discussed the above-mentioned issues with the World Bank.

SECRETARIAT'S RECOMMENDATION

10. Having regard to the reduction of costs to take account of the above issues, the Fund Secretariat recommends the capital costs be reduced by US $480,000 and the project be approved in the amount of US $360,000.

PROJECT EVALUATION SHEET

COUNTRY OR REGION:	Indonesia
PROJECT TITLE:	Elimination of ODS used in the manufacturing of Household Refrigerators at PT Sanyo Industries, Indonesia
BUDGET:	Capital Costs US $1,272,000 Operating Costs US $484,000
INCREMENTAL COSTS:	US $720,000[1]
ODS PHASE-OUT:	19.63 MT of CFC-12 52.75 MT of CFC-11
COST EFFECTIVENESS:	US $10.90 per Kg. ODP saved
PROJECT DURATION:	4 years
IMPLEMENTING AGENCY:	World Bank
NATIONAL COORDINATING AGENCY :	Indonesia State Ministry of Environment
TECHNICAL REVIEW COMPLETED:	YES _X_ NO _

SECRETARIAT'S COMMENTS

1. Implementation of this project will result in an estimated annual phase out of 19.63 MT of CFC-12 and 52.75 MT of CFC-11.

2. The replacement alternatives chosen by the company are HFC-134a as refrigerant and HCFC-141b as foam blowing agent. The company is researching a long-term option for a non-ODS blowing agent. Cyclopentane is considered as the most promising substitute. Where a final decision has been made, the company will submit another investment proposal for conversion to non-ODS technology. The Secretariat seeks guidance from the Executive Committee regarding funding for any such future project proposal.

3. PT Sanyo Industries Indonesia (SII) is a subsidiary of Sanyo, Japan with 35 per cent of local ownership. The actual production output of the company was 60,820 units in 1993. SII has been constructing the new production facility with production capacity about 320,000 units. SII expects to operate the new facility in February 1995 while production in the existing facility will stop in November 1994.

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[1] Including 15% contingency and 3% financial agent fee.

4. Sanyo Industries Indonesia is requesting funds retroactively to cover the costs incurred.

5. Capital costs of the project are associated with product development, technical assistance, training and conversion of the plant. Engineering assistance and training are provided by Sanyo, Japan.

6. Incremental operating costs are calculated for a 6 month duration.

7. The company realizes that the testing room can be used after initial testing is completed. The company proposes to cover 20 per cent of testing room costs.

8. The costs of model development, testing and training still remain very high, especially when taking into account that a new production facility is established.

9. Some cost items have been identified by the Secretariat as not eligible incremental costs.

10. Some costs associated with equipment items are significantly higher than competitive prices for same type of equipment.

11. A portion of operating costs was not recognized as eligible incremental costs.

12. The Secretariat extensively discussed the above-mentioned issues with the World Bank.

SECRETARIAT'S RECOMMENDATION

13. Having regard to the reduction of costs to take account of the above issues, the Fund Secretariat recommends the capital costs be reduced by US $680,000 and the project be approved in the amount of US $446,000.

PROJECT EVALUATION SHEET

COUNTRY OR REGION:	Indonesia
PROJECT TITLE:	Elimination of Ozone Depleting Substances used in the Production of Household Refrigerants at P.T. Sharpe Yasonta Indonesia
BUDGET:	US $4,234,000 (Capital costs) US $ 423,000 (Operating costs)
INCREMENTAL COSTS:	US $2,693,000[1] (incl. 15% contingency and 3% financial agent fee)
ODS PHASE-OUT:	77.9 MT of CFC-12 134.3 MT of CFC-11
COST EFFECTIVENESS:	US $15.59 per Kg. ODP saved
PROJECT DURATION:	Four years
IMPLEMENTING AGENCY:	World Bank
NATIONAL COORDINATING AGENCY :	Indonesia State Ministry of Environment
TECHNICAL REVIEW COMPLETED:	YES _X_ NO _

SECRETARIAT'S COMMENTS

1. Implementation of this project will result in an estimated annual phase out of 77.9 MT of CFC-12 and 134.3 MT of CFC-11.

2. The replacement alternatives chosen by the company are HFC-134a as refrigerant and cyclopentane as foam blowing agent. The project includes product development and conversion of the plant. Engineering assistance and training will be provided from its licensed company, Sharp Corporation of Japan. Special attention will be given on the safety issue of the cyclopentane usage.

3. Capital costs are associated with equipment procurement, non-ODS refrigerator product development, technical assistance from Sharp Co. of Japan, prototype testing and training.

4. Incremental operating costs are calculated at net present value for four years of production achieving the full installed capacity of 290,000 units in 1999. Ten per cent of total calculated operating costs are requested under this project.

1. Adjusted to reflect the local ownership of 49 per cent.

5. A substantial portion of existing equipment at household refrigerator manufacturing plans can be utilized while converting to no non-ODS substitutes if it is in good working condition. This approach has been applied in many conversion projects approved by the Executive Committee so far.

6. It is stated by the project document that installed equipment is in very good condition. However, most of the equipment is claimed to be replaced with new equipment under this project.

7. Costs associated with model developed and testing are about US $600,000, which substantially exceeds similar costs in many projects approved by the Executive Committee. The company is planning to increase production from 79,000 units to 290,000 units in 1999.

8. Some equipment items have been identified by the Secretariat as not being incremental costs and have not been recognized as eligible for funding.

9. Costs of some equipment items have been identified by the Secretariat to be exceeding competitive costs available on the market and applied in other similar approved projects.

10. The Secretariat has extensively discussed all the above-mentioned issues with the World Bank.

SECRETARIAT'S RECOMMENDATIONS

11. Having regard to the reduction of costs to take account of the above issues, the Fund Secretariat recommends the capital costs be reduced by US $2,500,000, and the project be approved in the amount of US $1,220,000.

PROJECT EVALUATION SHEET

COUNTRY OR REGION:	Indonesia	
PROJECT TITLE:	Reduction of CFC-12 Emission during Service of MAC by Use of Recycling Equipment	
BUDGET:	Phase I (1995 - 1996):	US $327,000
INCREMENTAL COST:	US $327,000	
ODS PHASE-OUT:	41 ODP tonnes	
COST EFFECTIVENESS:	US $6.67/kg	
PROJECT DURATION:	Two years	
IMPLEMENTING AGENCY:	World Bank	
NATIONAL COORDINATING AGENCY :	Indonesia Ministry of Environment	
TECHNICAL REVIEW COMPLETED:	YES _X_ NO __	

SECRETARIAT'S COMMENTS

1. The project proposal comprises two phases. The World Bank agreed with the Secretariat to process Phase I of the proposal.

2. This project will reduce CFC-12 emissions during the servicing of MAC units by installation of recycling equipment at multiple service shops. The project includes a training programme for service technicians, technical support, and equipment maintenance and repair to MAC service shops.

3. Practical implementation issues will be identified during a pilot phase (Phase I), in which 50 recycling machines will be installed, and will be resolved prior to full scale implementation (Phase II) in which another 320 machines will be installed.

4. The project proposal was reviewed by the Fund Secretariat. Based on the comments from the Secretariat on equipment being requested (procurement of a truck) and funding levels related to programme management, and discussions with the World Bank, the Bank agreed to review the project proposal accordingly. The project cost was reduced from US $603,550 to US $327,000. Due to time constraints, the project document could not be revised to reflect changes in costs of Phase I.

5. The project will provide a comprehensive assessment of the programme at the end of Phase I. This assessment will contain detailed information relevant not only to the design of Phase II of the project, but to also facilitate the design and implementation of MAC recycling programmes in other Article 5 countries. The assessment would be submitted to the Executive Committee, and be made publicly available, before submitting a project proposal for implementation of Phase II.

SECRETARIAT'S RECOMMENDATIONS

6. The Secretariat recommends as follows:

a. to approve the requested project costs at US $327,000.

b. To request the Government of Indonesia to submit the project proposal for the implementation of Phase II of the MAC recycling programme after the assessment of Phase I has been completed.

PROJECT EVALUATION SHEET

COUNTRY OR REGION:	Indonesia
PROJECT TITLE:	1. Conversion of Metal Cleaning Processes from 1.1.1 Trichloroethane (TCA) to Aqueous Cleaning at PT, Markindo Theco Company; 2. Conversion of Metal Cleaning Processes from 1.1.1 Trichloroethane (TCA) to Aqueous Cleaning at PT. INTI Company
BUDGET:	US $350,000 (Capital Costs) US $168,560[1] (Operating Costs)
INCREMENTAL COSTS:	US $531,100
ODS PHASE-OUT:	31.32 MT of 1.1.1 TCA (3.132 ODP-weighted tonnes)
COST EFFECTIVENESS:	US $169.57 per Kg. ODP saved
PROJECT DURATION:	12 months
IMPLEMENTING AGENCY:	World Bank
NATIONAL COORDINATING AGENCY :	State Ministry of Environment
TECHNICAL REVIEW COMPLETED:	YES _X_ NO _

SECRETARIAT'S COMMENTS

1. Two project proposals are addressed together in these comments.

2. Implementation of the two project proposals will result in an estimated annual phase-out of 31.32 MT of 1.1.1 TCA (3.132 ODP-weighted tonnes). The phase out of ozone-depleting substances will be accomplished by replacing the current degreasing, developing and stripping machines and manual cleaning processes with an aqueous (water-based) process.

3. The waste water effluent stream will be treated prior to discharge to drain in compliance with local regulations.

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1. Calculated for four years of operation.

4. Operating costs are calculated in each individual project for four years of operation.

5. Cost-effectiveness of these two projects is extremely low, owing to the fact that 1.1.1 TCA has a low ODP.

SECRETARIAT'S RECOMMENDATIONS

6. The Secretariat recommends approval of the project and the requested funding as itemized in the following table.

Company	ODS Phase-out MT/Year	Capital Costs	Operating Costs	Total Incremental Costs
P.T., Markindo Theco	21.6 1.1.1 TCA	226,000	127,000	335,000[1]
P.T., INTI	9.72 1.1.1 TCA	124,000	41,560	196,100[1]
Total	31.38 1.1.1 TCA	350,000	168,560	531,100

1. Includes 15 per cent contingency and 3 per cent financing agent fees.

PROJECT EVALUATION SHEET

COUNTRY OR REGION:	Indonesia
PROJECT TITLE:	1. Elimination of the Use of 1.1.1 TCA and CFC-113 in the Manufacture of Metal and Plastic Motorcycle Parts at PT KGD Indonesia, Inc.; 2. Elimination of the Use of 1.1.1 TCA in the manufacture of Nickel Plated Steel and Brass AA Battery Parts at PT FDK-Intercallin; 3. Elimination of the Use of CFC-113 in the Manufacture of Metal Personal Headphone Parts at PT Padma Pacific Sejahtera
BUDGET:	US $1,225,000 (Capital Costs) US $ 14,702[1] (Operating Costs)
INCREMENTAL COSTS:	US $543,310 [2]
ODS PHASE-OUT:	64.4 MT of 1.1.1 TCA (6.44 ODP MT) per year 11.5 MT of CFC-113 (9.2 ODP MT) per year
COST EFFECTIVENESS:	US $34.35 per Kg. ODP saved
PROJECT DURATION:	15 months
IMPLEMENTING AGENCY:	UNDP
NATIONAL COORDINATING AGENCY :	Indonesia Ministry of Environment
TECHNICAL REVIEW COMPLETED:	YES _X_ NO _

SECRETARIAT'S COMMENTS

1. Three project proposals are addressed together in these comments.

2. Implementation of these projects will result in an estimated annual phase-out of 64.4 MT of 1.1.1 TCA (6.44 ODP MT) and 11.5 MT of CFC-113 (9.2 ODP MT).

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1. Calculated for four years of operation.
2. Adjusted to reflect the local ownership.

3. The phase out of ODSs will be accomplished by replacing the current ODS degreasing processes with closed loop aqueous detergent solvent cleaning processes and non-ODS chlorinated solvent processes.

4. Incremental capital costs cover replacement of existing degreasing equipment with non-ODS cleaning installations and waste water treatment systems.

5. Incremental operating costs/savings are calculated per individual project.

6. The waste water effluent stream will be filtered and treated prior to discharge to drain in compliance with local regulations.

7. The cost-effectiveness is poor, owing to the fact that 1.1.1 TCA has a low ODP.

SECRETARIAT'S RECOMMENDATIONS

8. The Fund Secretariat recommends approval of the three projects and approval of incremental costs as follows:

Company	ODS Phase-out MT/Year	Capital Costs US $	Operating Costs (Savings) US $	Total Incremental Costs US $
P.T. KGD Indonesia Inc.	32 MT 1.1.1 TCA 10 MT of CFC-113	323,000	(29,700)	88,000[1]
P.T. FDK-Intercallin	32.4 MT 1.1.1 TCA	732,000	58,192	299,100[2]
P.T. Padma Pacific Sejahtera	1.5 MT CFC-113	170,000	(13,790)	156,210
Total	64.4 MT 1.1.1 TCA 11.5 MT CFC-113	1,225,000	14,702	543,310

1. Adjusted according to 30 per cent local ownership.
2. Adjusted according to 46 per cent local ownership and enterprise contribution (US $140,000).

The Montreal Protocol on
Substances that Deplete the Ozone Layer
Indonesia ODS Phaseout Project

Project Cover Sheet

COUNTRY :	Republic of Indonesia
PROJECT TITLE :	Conversion of Metal Cleaning Processes from 1,1,1-Trichloroethane (TCA) to Aqueous Cleaning at PT. INTI
SECTOR COVERED :	Solvent Cleaning
ODS USE IN SECTOR :	160 MT of CFC-113 in 1992 2,198 MT of 1,1,1-Trichloroethane in 1992 115 MT of Carbon Tetrachloride in 1992 474.3 MT of Total ODP-weighted consumption
PROJECT IMPACT :	Eliminate annual consumption of 9.72 MT of TCA (0.97 ODP-weighted MT)
PROJECT DURATION :	12 months
PROJECT ECONOMIC LIFE :	10 years
TOTAL PROJECT COST :	ODS Reduction Investment Costs : US$ 124,000 Incremental Operating Costs : US$ 41,560
COST - EFFECTIVENESS :	US$ 34.25 / ODP-weighted kg
PROPOSED OTF FINANCING : 1)	US$ 196,100 as a grant
IMPLEMENTING ENTERPRISES :	PT. Industri Telekomunikasi Indonesia (Persero) - PT. INTI
COORDINATING MINISTRY :	State Ministry of Environment (LH)

PROJECT SUMMARY

This project will phaseout 9.72 MT of TCA consumption in the manufacture of Printed Circuit Board (PCB) at PT. INTI. PT. INTI produces several types of telephone such as desk telephones, public payphones, mobile telephone system, digital telephone swithcing equipment, and digital PABX. The products are locally marketed. TCA is used as a developer in the manufacture of PCBs at PT. INTI. The phaseout of ozone depleting solvents (ODS) will be accomplished by replacing the current developing and stripping machines with aqueous-based machines.

TECHNICAL ASSESSMENT

This project proposal is being submitted to the OORG reviewer for a final approval.
The revised project has addressed the reviwer's comments about numerical discrepancies.

1) Include 15 percent contingency and 3 percent financing agent fee.

PROJECT OBJECTIVE

The objective of this project is to eliminate the use of TCA in PCB cleaning operations at PT. INTI. The use of TCA in developing and cleaning during the manufacture of PCBs will be replaced with aqueous cleaning based on sodium carbonate (Na_2CO_3).

SECTOR BACKGROUND

The solvent cleaning process sector represents the largest use of Ozone Depleting Substances (ODS) in Indonesia with 31% of total consumption. On an ozone depletion potential (ODP) weighted basis, the 1992 Indonesia consumption in the solvent sector amounted to 474.3 MT, or approximately 7.22% of total weighted consumption in the country.

In 1992 the solvent cleaning sector consumed 2,198 MT of TCA, 160 MT of CFC-113, and 115 MT of Carbon Tetrachloride (CTC). The rapid increase in the use of ODS in solvent cleaning applications in Indonesia is a result of an expansion of the electronics and metal cleaning industries, particularly through investment in joint ventures of captive Indonesia owned companies, by Japanese, European, and American firms. The metal cleaning processes account for approximately 50% of total ODS consumption in the solvent sector in Indonesia.

Metal parts cleaning includes most gross cleaning processes of large or heavily soiled parts. Most metal cleaning can be found in industries such as transportation (land and air), shipyard, basic metal, and machinery. Electronic cleaning processes include circuit-card and electronic part cleaning.

There are a large number of companies that use ODS in small quantities, but their number are not known because while some register as businesses, many do not. These companies generally buy their solvents and their parts in relatively small quantities from retailers and they manufacture items such as kitchen tools, car polish, black smith product, iron work, plastics, and jewelry.

Additionally there are in the industry tailors, service and repair shops, and sewing machine users (garment manufacturers). The largest subsector within the small scale industry is construction workers, who use solvent for cleaning parts and tools. Handicraft industries are another category of ODS solvent user.

ENTERPRISE BACKGROUND

PT. INTI is state-owned company under the agency of Strategic Industries of the Republic of Indonesia (BPIS). It was officially founded on December 30th, 1974 and now employs 1904 employees at its manufacturing facility in Bandung.

PT. INTI is the largest Indonesian telecommunications equipment manufacturer which produces digital telephone switching equipment, desk telephones, public payphones, mobile telephone system, digital PABX, and other telecommunication system. Almost all of these products require the use of the Printed Circuit Board (PCB), therefore PT. INTI now also manufactures high quality PCBs. In 1993 its production capacity is 6,000 square meters/shift of PCB, for making total production about 1,055,318 units of equipments.

PT. INTI consumed 9.72 MT of TCA in 1993 for developing and cleaning in the manufacture of PCB.

PROJECT DESCRIPTION

PT. INTI will replace the use of TCA in the developing process of PCB with aqueous cleaning based processes. Currently, INTI uses TCA in developing process to remove non-cross linked dry film from metal coated epoxy and followed by stripping process to remove cross linked dry film with methylene chloride (MeCl) as the solvent.

In new process of awueous cleaning system, there is also need to replace the type of dry film photoresist which impact to the stripping process. Consequently cleaning process in stripper will use aqueous system. The new cleaning equipment will be used to replace both of the developing and stripping machines. The new developing process will use sodium carbonate as a solvent and stripping process will use sodium hydroxide.

PT. INTI will incur costs for the following project elements:

1. Puchase one developing process equipment
2. Purchase one stripping process equipment
3. Purchase one wastewater treatment tank
4. Installation and training
5. Recurring costs (including labor, electricity, wastewater treatment)

Each of these is explained in detail below :

The aqueous cleaning equipment will include one developing machine, one stripping machine, and one wastewater treatment tank.

In the process production, PT. INTI uses a large amount of water, therefore the wastewater treatment is required. Now, PT. INTI has several wastewater treatment tanks. The new developing and stripping processed will use more water, so that PT. INTI request one wastewater treatment tank.

Employees will be trained in the proper use of the new equipment, and maintenance personnel will be trained in the best methods of calibrating and controlling the machinery.

Incremental costs associated with the difference in cost of electricity, solvents and labor are included.

JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY

In the solvents sector, there are limited options to the use of ozone-depleting solvents. Among the options are non-ODS chlorinated solvent cleaning, organic solvent cleaning, semi-aqueous solvent cleaning, aqueous cleaning, and "no-clean" or the modification of upstream processes to remove the need for cleaning in downstream processes. In the case, PT. INTI chooses the an aqueous cleaning process to eliminate its use of TCA in the manufacture of printed circuit boards.

At the present time, TCA is used in the manufacture of printed circuit boards as both as a developer and a cleaning agent. After the circuit pattern is exposed on the PCB, the exposed PCB is run through an in-line developing machine that uses TCA as the developing solvent. The PCB is then run through a similiar in-line stripping machine that uses methylene chloride to strip away the unexposed photoresist, Finally, the PCB is run through the TCA machine once again for a final cleaning before it is sent to the assembly shop.

Through a technical cooperation agreement, PT. INTI has worked with Siemens AG of Germany to identify aqueous cleaning as the optimal alternative for its use of TCA in developing and cleaning. However, this switch will require a switch to an aqueous-processable dry film photoresist from the current solvent-processable photoresist. Because the new photoresist can not be effectively removed by methylene chloride, PT. INTI will also require an aqueous machine for photoresist stripping.

Aqueous cleaning is an optimal choise for PT. INTI because it will result in little effect on the environment. PT. INTI has already demonstrated its environmental stewardship in terms of wastewater discharge through its operation of on-site wastewater treatment facility. By switching to an water-based cleaning process, the company will be assured of minimal environmental impact because of the use of its treatment facilities.

PROJECT COST[2]

Total Project Cost

As described below and presented in detail in the relevant annexes, the total project cost is US$ 165,560 Because there are no non-ODS investment costs associated with this project, the total project cost equals the ODS reduction portion of the overall project.

Investment Cost

As detailed in Annex 1 the total investment cost is US$ 124,000. Major components of this cost include the purchase and installation of in-line aqueous cleaning equipment machines and one wastewater treatment (US$ 100,000) as well as costs associated with technical assistance (US$ 10.000).

Operating Cost

If the project was not undertaken, the annual operating cost, exclusive of tax, would be US$ 122,236 If the project is implemented, the annual operating costs will be US$ 141,664 resulting an annual incremental operating costs of US$ 14,422 Given an equipment lifetime of 10 years and a discount rate of 10 percent, the net present value of the first four years of incremental operating costs is US$ 41,560 A more detailed breakdown of operating costs is provided in Annex 2.

Unit Abatement Cost (UAC)

As shown in Annex 3, The UAC for this project is US$ 34,25 per ODP-weighted kilogram of TCA phased out per year. This number is derived from annualized incremental capital costs of US$ 20,180, first year incremental annual operating costs of US$ (13,111), and savings of 9,720 kg (weighted) of ODP per year.

Proposed OTF Grant

The proposed OTF grant for PT. INTI is US$ 196,100 and was calculated as follows. First, the total investment cost of US$ 124,000 was added to the present value of the incremental operating cost over the first four years of the project, which is US$ 41,560 The resulting total of US$ 165,560 was multiplied by the percent Indonesian ownership (100-percent) of the facility to yield the grant amount. In the case of PT. INTI, there was no reduction in proposed grant due to foreign ownership.

SCHEDULE

TASK	Q1	Q2	Q3	Q4
Finalize specifications, tenders, review bids, select equipment	xxx			
Site preparation		xxx		
Equipment arrival		x		
Installation of equipment			xx	
Start-up, trials, and training				xx

REQUIRED REGULATORY ACTIONS

No regulatory actions, other than routine permitting, are required to implement this project. Under existing agreement with the World Bank, equipment and machinery imported as part of this project will be exempt from import duties levied by government of Indonesia.

RESULT

Direct Project Impacts

The project will eliminate 9.72 MT per year of TCA at PT. INTI.

Indirect Project Impacts

This project will not have any indirect project impact. Assuming a successful transition to the use of aqueous developing, stripping, and cleaning processes, the performance of INTI's product will remain unchanged. Because of the favorable economics of this proposal, there is unlike to be any impact on product price. Absent a charge in quality or price, consumer demand and production levels are expected to be uneffected by the project. The environmental impact associated with this project are discussed in Annex 4.

ANNEX A
INVESTMENT COSTS

DESCRIPTION	QTY.	REQUESTED FUND *)
A.1 EQUIPMENT - DEVELOPING MACHINE - STRIPPING MACHINE - WASTEWATER TREATMENT TANK		100,000
EQUIPMENT INSTALATION (SUPPLIER & STAFF)		10,000
TECHNICAL ASSISTANCE		10,000
TRANSPORTATION, SHIPPING, INSURANCE		4,000
TOTAL INVESTMENT COST		124,000

*) This price of equipment is a package price from Siemens, Germany, Which have a signed Contract with INTI. Siemens is Consultant for main equipment of INTI.

ANNEX B
INCREMENTAL OPERATING COSTS

		1993	1994	1995	1996	1997	1998
GROWTH RATE	0 %						
TCA USE (KG)		9,720	9,720	9,720	9,720	9,720	9,720
ODP OF TCA (KG)	0.1	972	972	972	972	972	972
AVERAGE USE OF TCA (KG ODP,1995 T0 1998)		972					

TABLE B.1. INCREMENTAL OPERATING COST

DESCRIPTION	QTY.	PRICE	1994	1995	1996	1997	1998
BASELINE COST:			122,236	122,236	122,236	122,236	122,236
Solvent Cost per year							
– TCA (drum)	36	401	14,436	14,436	14,436	14,436	14,436
– MeCl (drum)	48	220.5	10,584	10,584	10,584	10,584	10,584
Chemical Cost per Year							
– PTE Riston Type 1215 (roll)	60	193	11,580	11,580	11,580	11,580	11,580
– STDI Riston Type 1215 (roll)	156	170.21	26,553	26,553	26,553	26,553	26,553
– VACREL Type 930 (roll)	90	632	56,880	56,880	56,880	56,880	56,880
Electric Cost per Year							
– Developing Machine (kwh)	6,000	0.11	660	660	660	660	660
– Stripping Machine (kwh)	6,000	0.11	660	660	660	660	660
Man Power Cost per Year	2	441.5	883	883	883	883	883
PROJECT COST:			135,347	135,347	135,347	135,347	135,347
Solvent Cost per Year							
– Water (cubic meters)	1,440	0.014	20	20	20	20	20
Chemical Cost per Year							
– PTE Riston Type 8215 (roll)	76	126	9,576	9,576	9,576	9,576	9,576
– STDI Riston Type 8215 (roll)	190	126	23,940	23,940	23,940	23,940	23,940
– VACREL Type 8130 (roll)	92	1000	92,000	92,000	92,000	92,000	92,000
– NA2CO3 (kg)	800	1.4	1,120	1,120	1,120	1,120	1,120
– NAOH (kg)	1,200	1.64	1,968	1,968	1,968	1,968	1,968
Electric Cost per Year							
– Developing Machine (kwh)	20,400	0.11	2,244	2,244	2,244	2,244	2,244
– Stripping Machine (kwh)	25,200	0.11	2,772	2,772	2,772	2,772	2,772
– Wastewater Treatment (kwh)	3,660	0.11	403	403	403	403	403
Man Power Cost per Year	2	441.5	883	883	883	883	883
Wastewater Treatment Cost per Year			421	421	421	421	421
Incremental Operating Cost			13,111	13,111	13,111	13,111	13,111
Net Incremental Operating Cost (DISCOUNT RATE 10%) (1995 to 1998)			41,560				

ANNEX C
CALCULATION OF UNIT ABATEMENT COST

C.1	ODS Saving		
	ODP of TCA		0.1
	Annual growth		0%
	Use of TCA per 1994 demand (KG)		972
	Average Annual ODP Phased-out (KG)		972
C.2	Incremental Capital Cost		
	Economic Life of Project (years)		10
	Total Investment Cost	US$	124,000
	Annualized Incremental Capital Cost	US$	20,180
C.3	Net Annualized Incremental Operating Cost	US$	13,111
C.4	Unit Abatement Cost (US$/kg ODP phased-out)		34,25

ANNEX D
ENVIRONMENTAL ASSESSMENT

In the proposed aqueous cleaning systems, deionized water will be used to clean metal parts. Aqueous cleaning processes are safe for workers and generally do not harm the environment. The use of water does not add volatile organic hydrocarbons to the air. However, the aqueous process will create a large quantity water slightly contaminated with hydrocarbon oils. This project includes funding for wastewater treatment.

It is unlike that the project will have an adverse environmental impact. PT. INTI will have to obtain permits from the necessary authorities prior to installation of the cleaning equipment.

2. Industri Telekomunikasi Indonesia (INTI)

2.1 This proposal refers to the elimination of trichloroethane (TCA), from INTI Indonesia. This Company is one of the largest manufacturers in the country, of telecommunications equipment, including digital telephone switching equipment, desk telephones, public payphones, mobile telephones etc.. Since almost all of these products require printed circuit boards (PCB) the Company manufactures all the PCBs necessary for its own requirements.

2.2 The Company uses 9.72 MT of TCA annually.

2.3 The project proposes the introduction of an aqueous board developing system and an aqueous board cleaning system.

2.4 The UAC in the first proposal was give as $24.03 per ODP Kg, using a figure of 1.365 ODP weighted MT annual CDS elimination.

2.5 In the final submission the UAC has increased to $34.25 per ODP Kg due to revision of the annual ODS elimination downwards from 1365 MT to 9.72 MT with only minor changes to the costs.

2.6 The project details are good: actual solvent costs are reduced to a small fraction of the original TCA costs by the use of water, ($25,000, including methylene chloride compared with $20? for water.) Chemical costs also compare very favourably between the solvent and aqueous systems, increasing by only 1.35 times. Energy costs, always a challenge in introducing an aqueous system, are moderate at 4.1 times the original solvent energy costs.

The Montreal Protocol on Substances that Deplete the Ozone Layer Indonesia ODS Phaseout Project

Project Cover Sheet

COUNTRY :	Republic of Indonesia
PROJECT TITLE :	Conversion of Metal Cleaning Processes from 1,1,1-Trichloroethane (TCA) to Aqueous Cleaning at PT. Markindo Theco
SECTOR COVERED :	Solvent Cleaning
ODS USE IN SECTOR :	160 MT of CFC-113 in 1992 2,198 MT of 1,1,1-Trichloroethane in 1992 115 MT of Carbon Tetrachloride in 1992 474.3 MT of Total ODP-weighted consumption
PROJECT IMPACT :	Eliminate annual consumption of 21.60 MT of TCA (2.16 ODP - weighted MT)
PROJECT DURATION :	12 months
PROJECT ECONOMIC LIFE :	10 years
TOTAL PROJECT COST :	ODS Reduction Investment Costs : US$ 226,000 Incremental Operating Costs : US$ 157,670
COST - EFFECTIVENESS :	US$ 40,06 / ODP - weighted kg
PROPOSED OTF FINANCING : 1)	US$ 363,600 as a grant
IMPLEMENTING ENTERPRISES :	PT. Markindo Theco
COORDINATING MINISTRY :	Indonesia Ministry of Environment (LH)
IMPLEMENTING AGENCY :	The World Bank

PROJECT SUMMARY

This project will eliminate the use of 1,1,1 trichloroethane (TCA) in the cleaning of small condenser and evaporator coils, at PT. Markindo Theco. This company is a manufacturer of condenser and evaporator coils for automotive air-conditioners. Its products are sold primariliy in Indonesia, with about 20 % being exported to Hong Kong, Philippines, and Australia. PT. Markindo Theco manufactures condenser and evaporator coils from the raw materials of aluminum sheet and copper and aluminum tubing. The phaseout of ozone depleting solvents (ODS) will be accomplished by replacing the current vapor degreasing and manual dip cleaning processes with an aqueous (water-based) cleaning process.

TECHNICAL ASSESSMENT

This project proposal is being submitted to the OORG reviewer for a final approval.
The revised proposal has addressed the reviewer's comments about numerical discrepancies and energy consumption.

1) Include 15 percent contingency and 3 percent financing agent fee.

PROJECT OBJECTIVE

The objective of this project is to eliminate the use of all TCA in cleaning operations at Markindo. (Hereafter refered to in this investment project proposal as Markindo) the use of TCA in metal cleaning applications will be replaced with aqueous cleaning.

SECTOR BACKGROUND

The solvent cleaning process sector represents the largest use of Ozone Depleting Substances (ODS) in Indonesia with 31% of total consumption. On an ozone depletion potential (ODP) weighted basis, the 1992 Indonesia consumption in the solvent sector amounted to 474.3 MT, or approximately 7.22% of total weighted consumption in the country.

In 1992 the solvent cleaning sector consumed 2,198 MT of TCA, 160 MT of CFC-113, and 115 MT of Carbon Tetrachloride (CTC). The rapid increase in the use of ODS in solvent cleaning applications in Indonesia is a result of an expansion of the electronics and metal cleaning industries, particularly through investment in joint ventures of captive Indonesia owned companies, by Japanese, European, and American firms. The metal cleaning processes account for approximately 50% of total ODS consumption in the solvent sector in Indonesia.

Metal parts cleaning includes most gross cleaning processes of large or heavily soiled parts. Most metal cleaning can be found in industries such as transportation (land and air), shipyard, basic metal, and machinery. Electronic cleaning processes include circuit-card and electronic part cleaning.

There are a large number of companies that use ODS in small quantities, but their number are not known because while some register as businesses, many do not. These companies generally buy their solvents and their parts in relatively small quantities from retailers and they manufacture items such as kitchen tools, car polish, black smith product, iron work, plastics, and jewelry.

Additionally there are in the industry tailors, service and repair shops, and sewing machine users (garment manufacturers). The largest subsector within the small scale industry is construction workers, who use solvent for cleaning parts and tools. Handicraft industries are another category of ODS solvent user.

ENTERPRISE BACKGROUND

Markindo is a company which produces heat exchanger for air conditioning system. The shareholders of the company are Thai Heat Exchange Co. Ltd. - Thailand (50%), PT. Sila Amanusaha - Indonesia (30%), and Grand Ocean (International) Ltd. - Hong Kong (20%).

Markindo was established in January 1991 and started its manufacturing operation in June 1992. It employs approximately 100 people in Indonesia and in 1993, it had revenue of US$ 2,190,000. Its products, evaporators and condensers, are mainly for automobile and 20% of them are exported to Hong Kong, Philippines, and Australia. Total production in 1993 was about 96,000 units.

Process for manufacturing its product begins with cutting process of copper tube, alumunium sheet, and galvanized steel sheet to make tube, fin, and plate. These components are parts of heat exchanger. After these parts were assembled, cleaning process were conducted, including dip cleaning and vapor degreasing. Then the process followed by brazing, leak testing, drying, measuring test, and finally packaging.

Markindo consumed 21.60 MT of TCA in 1993 for cleaning of heat exchangers. The cleaning process is necessary to remove oils and lubricants added to the components from the stamping, bending, and expanding process. The use of oil and lubricants is critical to permit proper impact stamping and to eliminate tube cracking in the bending and expanding process.

PROJECT DESCRIPTION

Markindo will eliminate the use of TCA in the manufacturing of condensers and evaporator coils with the use of an in-line aqueous cleaning process. Markindo currently uses a large TCA vapor degreaser for bulk cleaning and a small bucket of TCA for pre-cleaning. The new cleaning equipment will be used to replace both of the TCA cleaning processes. The switch from a relatively inert cleaning process to one where water is utilized as a solvent will require detailed aqueous cleaner.

Markindo will incur costs for the following project elements:

1. Purchase of one unit batch aqueous cleaning system and water supply system (including its hoist)
2. Purchase of wasted water treatment

3. Installation and training
4. Recurring costs (including labor, electricity, wastewater treatment, and cleaning chemicals)

Each of these is explained in detail below :

The aqueous cleaning equipment will include one ultrasonic cleaning machine in chemical tank, one hot water rinse tank, one water spray rinse tank with air blow and a drying oven as well as for improvement to facility exhaust system to ensure that contamination is minimized, a deionized water system will be included to provide pure water to the wash and rinse tanks. Markindo currently draws its process water supply from a well located on the manufacturing site to fulfill such big amount of water Markindo required a deep well pump at the site.

The funding will be incur for wasted water treatment system.

Funding is also requested for training of Markindo's staff and to prepare the site for the equipment installation. Employees will be trained in the proper operation of the new equipment and maintenance personnel will be trained in the best methods of calibrating the machinery and controlling electronics.

Incremental costs associated with the differences in cost of electricity, solvents, and labour.

JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY

In the solvents sector, there are limited options to the use of ozone depleting solvents. Among the options are non-ODS chlorinated solvent cleaning, organic solvent cleaning, semiaqueous solvent cleaning, aqueous cleaning, and "no-clean" (the modification of upstream processes to remove the need for cleaning in downstream processes). The use of aqueous cleaning ensures that air pollution will not result from changing the cleaning process. Other options, such as the use of organic solvents, contribute to global warming or formation of smog, a serious problem in the urban area of Jakarta. In metal cleaning such as that at Markindo, the switch to no-clean processes is made by the use of evaporative oils or lubricants. The evaporative types of hydrocarbons are contributors to local air pollution and do not represent good environmental stewardship.

Markindo chooses to use aqueous-based processes because the efficient use of water as a solvent will not damage the environment and because water is a plentiful, inexpensive resource in Indonesia. The use of aqueous cleaning in which the water is recycled for reuse will conserve a natural resource and will reduce process waste. Aqueous cleaning processes are widely used in the U.S., Japan, and other industrialized countries, and when properly controlled, have proven effective in removing lubricants and other hydrocarbon contamination.

Markindo expects that the quantity of products to be cleaned will increase over the next two years from 163,000 units per year in 1994 to 210,000 units in 1995. By 1996, the productivity will reach 420,000 units per year. The current cleaning equipment is a batch process and the through put can be expanded by modifying the number of unit in each cleaning batch, or by decreasing batch processing time.

Markindo Theco has sufficient mechanical capability, to operate the new system.

PROJECT COSTS[2]

Total Project Cost

As described below and presented in detail in the relevant annexes, the total project cost is US$ 363,600 . Because there are no non-ODS investment costs associated with this project, the total project cost equals the ODS reduction portion of the overall project.

Investment Cost

As detailed in Annex 1, the total investment cost is US$ 226,000. Major components of this cost include the purchase and installation of one medium-volume aqueous cleaning machine (US$160,000), and a waste water treatment system (US$ 27,000), as well as costs associated with the training and installation (US$ 10,000).

Operating Costs

If the project was not undertaken, the annual operating cost, exclusive of tax, would be US$ 33,767. If the project is implemented, the annual operating cost will be US$ 49,740 , resulting in an annual incremental operating costsd of US$ 115,648. Given an equipment lifetime of 10 years and a discount rate of 10 percent, the net present value of the first four years of incremental operating costs is US$ 157,670 . A more detailed breakdown of operating costs is provided in Annex 2.

Unit Abatement Cost (UAC)

As shown in Annex 3, the UAC for this project is US$ 40,06 per ODP-weighted kilogram of TCA phased out per year. This number is derived from annualized incremental capital costs of US$ 36,780 first year incremental annual operating costs of (US$ 49,740), and savings of 2.16 MT (weighted) of ODS per year.

Proposed OTF Grant

The proposed OTF grant for Markindo is US$ 363,600 [7] and was calculated as follows. First, the total investment cost of US$ 226,000 was added to the present value of the incremental operating cost over the first four years of the project, which is US$ 157,670. Markindo is 30% Indonesia-owned. However, because its parent company, Thai Heat Exchange Company, is located in an Article 5 country, the total of the investment and incremental operating costs (US$ 644,011) was multiplied by the percent ownership by Article 5 countries (80 percent) to yield the grant amount.

SCHEDULE

TASK	Q1	Q2	Q3	Q4
Finalize specifications, tenders, review bids, select equipment	XXX			
Site preparation		XXX		
Equipment arrival		X		
Installation of equipment			XX	
Start-up, trials, and training				XX

REQUIRED REGULATORY ACTIONS

No regulatory actions, other than routine permitting, are required to implement this project. Under existing agreement with the World Bank, equipment and machinery imported as part of this project will be exempt from import duties levied by the government of Indonesia.

RESULTS

Direct Project Impacts

The project will eliminate 21.6 MT per year of TCA at Markindo

Indirect Project Impacts

This project will not have any indirect project impacts. Assuming a successful transition to aqueous cleaning, the preformance of Markindo Theco's product will remain unchanged. Because of the favorable economics of this proposal, there is unlikely to be any impact on product price. Absent a change in quality or price, consumer demand and production levels are expected to be unaffected by the project. The environmental impacts associated with this project are discussed in Annex 4.

ANNEX A
INVESTMENT COST

DESCRIPTION	UNIT	REQUESTED FUNDING
Water Supply :		
Simple Deionized Water System	1	5,000
Deep Well Pump	1	2,000
Storrage Tank	1	6,000
Aqueous Cleaning Systems :		
Tank Ultrasonic Clean in Chemical	1	90,000
Hot Water Rinse	1	30,000
Water Spray Rinse and Air Blow Tank	1	10,000
Drying Oven	1	30,000
Wastewater Treatment		
Wastewater Treatment System	1	25,000
Transfer Pump	1	2,000
Station Hoist and Control		10,000
LPG Supply		6,000
Training and Installation		
Equipment Training (Theco's Staff)		5,000
Equipment Installation (Supllier).		5,000
TOTAL		226,000

ANNEX B

BREAKDOWN OF INCREMENTAL COSTS / SAVINGS

Estimated Costs in US Dollars

Growth Rate 10%	1993	1994	1995	1996	1997	1998
TCA Used (kg)	21,600	21,600	21,600	21,600	21,600	21,600
ODP of TCA 0.1						
Average Use of TCA (kg) (1995 to 1998)		21,600				
Average kg ODP-weighted Saved (1995 - 98)		2,160				

TABLE B.1 INCREMENTAL OPERATING COST

DESCRIPTION	QTY.	PRICE	1994	1995	1996	1997	1998
BASELINES COSTS			33,767	33,767	33,767	33,767	33,767
Solvent Costs per Year : TCA (drum)	80	347.14	27,771	27,771	27,771	27,771	27,771
Electric Costs per Year : Current System (kwh)	4,224	0.124	524	524	524	524	524
Manpower Costs per Year : Current System (3 workers) (man-hours/year)	5,760	0.95	5,472	5,472	5,472	5,472	5,472
PROJECT COSTS			83,507	83,507	83,507	83,507	83,507
Chemical Costs per Year : Chemical Used in Washing Stage (liter)	6,000	6.5	39,000	39,000	39,000	39,000	39,000
Water Costs per Year (cubic meters)	1,000	0.3	300	300	300	300	300
Electric Cost							
Cleaning system (KWh)	28,800	0.124	3,571	3,571	3,571	3,571	3,571
Deep Water & Transfer Pump(KWh)	9,000	0.124	1,116	1,116	1,116	1,116	1,116
LPG (kg)	36,000	0.4	14,400	14,400	14,400	14,400	14,400
Manpower Costs per Year (5 workers)(man-hours/year)	9,600	0.95	9,120	9,120	9,120	9,120	9,120
Water Treatment Costs per Year :							
Resin Regeneration			15,000	15,000	15,000	15,000	15,000
Filter Maintenance			1,000	1,000	1,000	1,000	1,000
Incremental Operating Cost			49,740	49,740	49,740	49,740	49,740
Net Incremental Operating Cost (1995 to 1998)			157,670				

ANNEX C
CALCULATION OF UNIT ABATEMENT COST

C.1 ODS Saving

ODP of TCA		0.1
Annual growth		0%
Average Annual ODP Phased-out (KG)		2,160

C.2 Incremental Capital Cost

Economic Life of Project (years)		10
Total Investment Cost	US$	316,000
Annualized Incremental Capital Cost	US$	36,780

C.3 Net Annualized Incremental Operating Cost	US$	49,740
C.4 Unit Abatement Cost (US$/kg ODP phased-out)		40,06

ANNEX D
ENVIRONMENTAL ASSESSMENT

In the proposed aqueous cleaning systems, deionized water will be used to clean metal parts. Aqueous cleaning processes are safe for workers and generally do not harm the environmental. The use of water does not add volatile organic hydrocarbons to the air. However, the aqueous process will create a large quantity water slightly contaminated with hydrocarbon oils. This project' includes funding for a wastewater treatment and recycling system that will enable al of the water to be recycled to the cleaning system. Solid waste in the form of filters and resin columns will be properly regenerated by an outside firm.

It is unlikely that the project will have an adverse environmental impact. Markindo will have to obtain permits from the necessary authorities prior to installation of the cleaning equipment.

3. Markindo Theco.

2.1 This proposal refers to the Makindo Company which manufactures refrigerant evaporators for air conditioning equipment.

2.2 The process involves copper tube, and aluminium and galvanised sheet which is formed into tube fin and plate components for the heat exchangers. After assembly the parts must be cleaned and dried by dip cleaning and vapour degreasing. Reliable cleaning is essential for the proper forming of brazed joints.

2.3 Makindo used 21.6 MT of trichlorethane in 1993 for these processes.

2.4 The proposal is based on the introduction of an aqueous cleaning system for all metal components and finished sub-assemblies required for manufacture of the heat exchangers.

2.5 The unit abatement costa for this project are $40.06 per ODP Kg.

2.6 The major criticism of the proposal concerns the very large increase in energy consumption in changing from solvent cleaning to an aqueous system. The cost of electrical and LPG heating is $19087 compared with $524 for the TCA system. This is a factor of 36 times. The chemical costs in contrast increase by only 1.4 times.

2.7 These figures for the very high energy requirements for aqueous systems emphasise the greatest disadvantage of such cleaning systems. Whilst it is acknowledged that the prime aim of industry is the rapid and complete phase out of ozone depleting compounds it is of concern that this could involve a large increase in energy consumption and resultant increase in global warming gases such as carbon dioxide.

2.8 Several European manufacturers are introducing retrofit systems to contain the vapours from solvent cleaning systems, and one at least has a completely contained system with close to zero emission. These could be considered as options for the safe use of chlorinated solvents without the risk of increasing the energy demand.

INS.01

PROJECT COVER SHEET

COUNTRY: Republic of Indonesia

PROJECT TITLE: Elimination of the use of 111 TCA and CFC113 in the manufacture of metal and plastic motorcycle parts at PT KGD Indonesia, Inc.

SECTOR COVERED: Solvent

ODS USE IN SECTOR:
(1992 basis)
160 MT of CFC113 in 1992
2198 MT of 1,1,1, Trichloroethane in 1992
115 MT of Carbon Tetrachloride in 1992
474 MT of ODP weighted consumption

PROJECT IMPACT: 32 MT of 111 TCA per year (3.2 ODP MT)
10 MT/yr of CFC113

PROJECT DURATION: 14 months

PROJECT USEFUL LIFE: 10 years

TOTAL PROJECT COSTS: Total capital investment cost:USD 323 000

NPV of incremental
operating cost: USD -29,700

PROPOSED MLF GRANT: USD(293,300 x 30% local ownership) = 88,000

COST EFFECTIVENESS: USD 6.9 $/kg

NATIONAL
COORDINATING AGENCY: Indonesia Ministry of Environment (LH)

IMPLEMENTING AGENCY: UNDP

PROJECT SUMMARY

This project will eliminate the use of both CFC 113 and TCA in the cleaning of metal and plastic motorcycle parts at PT KGD Indonesia, Inc. The company is a 30% locally owned enterprise providing headlights, wiring harnesses, tail light covers, and silver/aluminum coated reflector surfaces for the various lights. Most of the parts are consumed locally. PT KGD manufactures the parts from stainless steel sheet, aluminum and various plastic raw materials. The phaseout will be accomplished by replacing the current vapor degreasing processes with solvent and aqueous/solvent processes.

PROJECT OF THE GOVERNMENT OF INDONESIA:

ELIMINATION OF THE USE OF 111 TCA AND CFC113 IN THE MANUFACTURE OF METAL AND PLASTIC MOTORCYCLE PARTS AT PT KGD INDONESIA, INC.

1. PROJECT OBJECTIVE

The objective of this project is to phase out the use of all ozone depleting solvent processes at PT KGD, Indonesia.

2. SECTOR BACKGROUND

The ODS consumption in the Indonesian solvent sector is estimated to have reached 115 MT of carbon tetrachloride, 160 MT of CFC-113 and 2198 MT of 111 TCA in 1992. This sector represents the largest use of ODS - 31% of the total consumed in that year. On an ODP basis, the total solvent consumption was 474 MT, or 7.22% of the total consumed by the country. The sector has increased rapidly, primarily as a result of the expansion of the electronics and metal cleaning industries through investment from joint ventures.

The metal cleaning processes account for approximately 50% of the total consumption of the solvent section in Indonesia. This subsector includes most gross cleaning processes of large or heavily soiled parts, and can be found in industries such as transportation, shipyard, basic metal, and machinery. The electronic cleaning processes include the cleaning of printed circuit boards, electronic parts cleaning, and the cleaning of electronic board assemblies after soldering.

A large number of companies use ODS in small quantities, but their number os unknown, because while some register as businesses, many do not. These companies generally buy their solvents and parts in relatively small quantities from retailers, and they manufacture items such as kitchen tools, car polish, iron work, plastics and jewelry.

3. ENTERPRISE BACKGROUND

KGD was established in 1981 and commenced operations the next year. It is a 30% Indonesian owned enterprise, with 70% Japanese partners in the joint venture.

The company employs 900 people and produces a wide range of plastic parts, reflectors for headlamps, wiring harnesses, and stamped and cast metal parts, for the motorcycle industries, e.g., Suzuki, Yamaha, Honda, etc. In 1992, the company consumed approximately 32 MT of 111 TCA and 10 MT of CFC 113 in the cleaning of metal parts, in the precision cleaning of motorcycle headlight reflectors, and in the cleaning of a number of plastic parts and pieces for motorcycle wiring harnesses, tail lights and headlights.

4. PROJECT DESCRIPTION

4.1 PROCESS SOILS

A number of process soils need to be removed in the various cleaning processes. In the TCA cleaning operations, Silicon mold release agents (e.g.,CORIUM 178 - Australia), Anti-rust/corrosion oil (WD-40), machine oils, drilling shavings, and small metal particulates need to be routinely removed. In a separate operation, hard, dried paint is being removed in the cleaning of a special jig used to paint the various motorcycle parts. In the CFC 113 cleaning operations, the precision cleaning of mold release oils and fine particulates is critical to the quality of the next production step, i.e., aluminum-silver mirror finish coating via vacuum deposition. Mold release silicon oils are also removed from a number of plastic parts via isopropyl alcohol (IPA).

4.2 PRESENT PROCESS

To carry out the cleaning operations and the removal of the soils described above, the following processes are deployed.

a The first process is a cold cleaning operation using TCA to remove the hard, dried paint from the painting jig, which is immersed in a TCA cold cleaning bath.

b The second process is a hand cleaning operation on plastic parts to remove the mold release oils, using Isopropyl alcohol.

c The third process employs a chlorinated solvent vapor degreaser for the metal parts which are next given an injection mold coating. This is a Japanese vapor degreaser, Nihon Kakohki Kogyo, Ltd., SN T4273

d The fourth process utilizes a Kakohki chlorinated solvent vapor degreaser, Model B-2, SN 4275 to remove machine oil and drilling particulates from aluminum parts, prior to sending them to the next step - an assembly line.

e The fifth process uses a Japanese made vapor degreaser to remove mold release oils and fine particulates in a precision cleaning operation prior to the next step - i.e., a critically sensitive vacuum deposition of alumina-silver mirror coatings on the surfaces of headlight reflector cones.

4.3 PROPOSED ALTERNATIVE PROCESSES

Non-ODS solvents will be used to replace the TCA solvent processes, i.e. a mild hydrocarbon and/or TCE alternative, combined with a modification of the existing vapor degreasing processes to permit the safe use of the alternative solvent technology. The cost of modifications will be essentially equivalent for the alternative solvents, although the scope of the modifications will be different.

A flammable solvent/IPA drying process will be used as the replacement process to clean and dry the plastic headlight reflector bases.

5. TECHNOLOGY

In the solvent sector, there are several options to the use of 111 TCA and the use of CFC 113 for metal cleaning and the cleaning of plastic parts:

- aqueous (employs detergents and water rinses to achieve cleanliness)
- semi-aqueous (uses solvents and water rinses to achieve cleanliness)
- non-ODS chlorinated solvents
- hydrocarbon solvents

The company has chosen to use non-ODS solvents to replace the TCA solvent processes. The use of aqueous or semi-aqueous technology in the metal cleaning operations was not considered to be as cost effective as using a mild hydrocarbon or TCE alternative, combined with a modification of the existing vapor degreasing processes to permit the safe use of the alternative technology.

Similarly, the company chose to use a flammable solvent, combined with an IPA rinsing/drying process to clean and dry the plastic headlight reflector bases, because the slightest water spotting would be considered totally unacceptable from a coating quality standpoint, since the slightest residue will be coated over in the subsequent mirror finish depositing step, and would appear as a significant surface defect.

6. PROJECT COSTS

6.1 TOTAL CAPITAL COSTS

The following summarizes the anticipated investment cost and related activities:

DESCRIPTION	SUB-TOTAL	TOTAL
· Modify 2 TCA Cleaning systems	$60,000	
. Hoists and covers	15,000	
Warm air drying unit	25,000	

		100,000
· Flammable solvent cleaning plant	145,000	
· Piping and fume exhaust	10,000	
· Electrical wiring	10,000	
· Flammability instrumentation	15,000	
. Air monitoring tests before startup	7,000	

		187,000
· Training & engineering		6,000
· Process & material compatibility testing		4,000
. Contingency & rounding		26,000

TOTAL		$323,000

6. PROJECT COSTS (continued)

6.2 INCREMENTAL OPERATING COSTS

The following table summarizes the incremental operating cost:

ITEM		PRESENT SYSTEM	PROPOSED SYSTEM
1)	TCA chemical cost	$30,720 (32MT x $0.96)	
	CFC 113 cost	$80,000 (10MT x $8.00)	
	New Solvent		$80,000 (32MT x $2.50)
	Flammable solvents		$20,000 (10MT x $2.00)
2)	Labour cost	$16,000	$16,000
3)	Energy cost	$ 750 ($0.06/hp x 8/day x 312 x 5hp)	$ 600 ($0.06 x 8 x 312 x 4)
4)	Maintenance	$ 1,000	$ 2,500
	Total	$128,470	$119,100
	Difference	$-9370	

NPV of 4 Year Difference =0.7925 x -9,370 x 4 = $-29,700

6.3 UNIT ABATEMENT COST

- ODS reduction capital cost................USD 323,000
- Annual incremental cost..................USD (9370)
- Project useful life............................ 10 years
- ODS reduction.................................. 13,200Kg
- % local ownership 30%

. Unit Abatement Cost [(a/c + b) /d] US/kg/ 1.7 (ODP Basis)

7. FINANCING PLAN

The company requests reimbursement of the complete project costs, which are estimated to be: USD (323000) + (-29700) = 293,300, before ownership adjustments.

Since the Company is 30% Indonesian owned, the grant requested is $88,000.

8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT

UNDP will oversee the completion of this project.

8.2 SCHEDULE

The project will be considered complete when monitoring has confirmed that production volumes and cleanliness levels of parts either exceed or are equivalent to the 111 TCA and CFC 113 processes, and the work area is in compliance with all local safety and DOE regulations. It will be carried out according to the schedule below

Time for Completion

	1994				1995			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Project Preparation				X				
MLF Approval				X				
Order Equipment					X	X		
Process Modification					X	X		
Installation							X	
Trial Runs							X	
Compatibility Test for customers							X	X
Training							X	

Phaseout actually begins here (1995)

9. PROJECT IMPACT

This project will eliminate the use of at least 32 MT of 111 TCA and 10 MT of CFC113 during the first year of implementation.

10. ENVIRONMENTAL ASSESSMENT

Under this project, KGD will convert to cleaning systems which are technologically accepted world-wide. Since these are metal and plastic cleaning processes, removing process soils (as opposed to removal of acidic flux residue), it is unlikely that this project will have an adverse environmental impact, provided that the alternative solvent waste stream management is in compliance with regulations and accepted industrial standards.

GLOBAL CENTRE FOR PROCESS CHANGE

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TECHNICAL REVIEW

I have reviewed the Indonesia Project, "Elimination of the use of 111 TCA and CFC-113 in the manufacture of metal and plastic motorcycle parts at PT KGD Indonesia, Inc.", from the solvent sector, based on discussions with the author, as well as review of the project document.

1 Country of Origin — Indonesia

2 Project Title — Elimination of the use of 111 TCA and CFC-113 in the manufacture of metal and plastic motorcycle parts at PT KGD Indonesia, Inc.

3 Sector — Solvents

4 Relationship to C.P. — The project addresses how this factory ODS phase out fits in with the ODS using solvent subsectors in Indonesia. The Project relates to the C.P. via the description of the solvents used and the amounts to be phased out, although it does not directly write about the country programme.

5 Technology

Technical Soundness

This project substitutes several effective ODS alternative technology choices for the various metal and delicate plastic solvent cleaning operations to be replaced. It includes the process definition, qualification, and installation of cleaning technologies that will meet the unique needs of cleaning and spot-free drying of metal and plastic parts, as described in the project document. The need for spot-free parts prior to vacuum metalliztion is an especially critical application.

The use of flammable or combustible hydrocarbon or alcohol solvents in the replacement technology choice will somewhat restrict the equipment choices, but they will be effective and can be used safely if appropriate procedures are followed. The equipment must have minimal vapor loss, and generally uses either carbon dioxide or nebulizing water sprays, actuated by a multi-sensor detector system, for safe operation. The need for safe operating equipment incorporating these features, which is readily available, is specifically recognized in the project. The use of TCE as a non-ODS option is also addressed via the need to incorporate workplace air monitoring, enhance machine ventilation and provide hoists and cleaning machine covers to isolate the workers from the TCE vapors.

Safety

The use of flammable and potentially toxic solvents must provide for low exposure levels, both acutely and chronically, and operating procedures and equipment settings that prevent air/solvent mixtures which are potentially flammable. Thus, in order to control exposure and the creation of flammable situations during routine functions, it is important that handling such as loading, unloading, solution make-up, and solvent transfer procedures (including spent materials) be spelled out and people trained before they are permitted to become operators in the cleaning area. Periodic retraining is also recommended via review of the videotapes made during the on-site training provided by the cleaning equipment suppliers.

Provisions for safe maintenance must also be made, e.g. the use of spark proof tools and the measurement of flammable mix concentrations before entering the cleaning basket area of the equipment.

Appropriate operating interlocks, which should be installed as part of the equipment design, should be periodically checked for proper function. The interlocks should never be allowed to be bypassed if they begin to malfunction.

6 Environmental Impact

It is unlikely that this project will have an adverse environmental impact. since it will be reviewed with the Indonesia Ministry of Environment (LH) prior to implementation. Also, the project commits that "PT KGD Indonesia, Inc. will obtain equipment that is designed for use with flammable, evaporative, solvents and that has been designed to meet National Fire Protection Agency standards."

7 Project Costs

The cost components identified in the project cover the equipment required, including cleaning equipment roll top covers, hoists and ventilation improvements for workplace solvent vapor exposure control, plus operational cost components needed to run safely and under adequate environmental control. The cost of safety training and ongoing updates of that training are not included. These costs are not normally considered to be major elements in a project, and would not normally change the project cost materially.

8 Implementation Timeframe

The proposed implementation timeframe is feasible from an elapsed time standpoint. The actual date of startup, however, will be dependent upon the approval date.

9 Recommendation

The project is sound, needed, and has a level of cost effectiveness - USD 6.9/Kg ODP and a unit abatement cost of $1.7/Kg. ODP that is very good. Approval as proposed is recommended, with the proviso that the safety and environmental issues will be addressed.

William G. Kenyon
19 October, 1994

INS.02

PROJECT COVER SHEET

COUNTRY:	Republic of Indonesia
PROJECT TITLE:	Elimination of the use of 111 TCA in the manufacture of nickel plated steel and brass AA battery parts at PT FDK-Intercallin.
SECTOR COVERED:	Solvent
ODS USE IN SECTOR: (1992 basis)	160 MT of CFC-113 2198 MT of 1,1,1, Trichloroethane 115 MT of Carbon Tetrachloride 474 MT of ODP weighted consumption
PROJECT IMPACT:	32.4 MT/yr of 111 TCA
PROJECT DURATION:	12 months
PROJECT USEFUL LIFE:	10 years
TOTAL PROJECT COSTS:	Total capital investment cost: USD 732,000 NPV of incremental operating costs: USD 58,192 Total 790,192 Enterprise contribution (140,000) Net Project Expense 650,192
PROPOSED MLF GRANT:	USD 299,100 (USD 650,192 total, adjusted for 46% Indonesian ownership.)
COST EFFECTIVENESS:	93 $/kg
NATIONAL COORDINATING AGENCY:	Indonesia Ministry of Environment (LH)
IMPLEMENTING AGENCY:	UNDP

PROJECT SUMMARY

This project will eliminate the use of 111 TCA and in the cleaning of stamped metal AA battery parts at PT FDK-Intercallin, thus eliminating the ODS use at this factory. The company is a 46% locally owned enterprise providing AA alkaline storage batteries. PT FDK-Intercallin manufactures the battery cases from nickel plated steel roll stock. Each battery also contains brass parts, which require a different chemical surface treatment to perform properly The phaseout will be accomplished by replacing the current 111 TCA vapour degreasing process with a closed loop aqueous detergent cleaning process for stamping oil removal from both steel and brass parts and surface treatment of the brass parts.

PROJECT OF THE GOVERNMENT OF INDONESIA:

ELIMINATION OF THE USE OF 111 TCA IN THE MANUFACTURE OF METAL AA ALKALINE BATTERY CASES AT PT FDK-INTERCALLIN.

1. PROJECT OBJECTIVE

The objective of this project is to phase out the use of all ozone depleting solvent in both nickel plated steel and brass AA battery parts manufacturing processes at PT FDK-Intercallin.

2. SECTOR BACKGROUND

The ODS consumption in the Indonesian solvent sector is estimated to have reached 115 MT of carbon tetrachloride, 160 MT of CFC-113 and 2198 MT of 111 TCA in 1992. This sector represents the largest use of ODS - 31% of the total consumed in that year. On an ODP basis, the total solvent consumption was 474 MT, or 7.22% of the total consumed by the country. The sector has increased rapidly, primarily as a result of the expansion of the electronics and metal cleaning industries through investment in joint ventures.

The metal cleaning processes account for approximately 50% of the total consumption of the solvent section in Indonesia. This subsector includes most gross cleaning processes of large or heavily soiled parts, and can be found in industries such as transportation, shipyard, basic metal, and machinery. The electronic cleaning processes include the cleaning of printed circuit boards, electronic parts cleaning, and the cleaning of electronic board assemblies after soldering.

A large number of companies use ODS in small quantities, but their number is unknown, because while some register as businesses, many do not. These companies generally buy their solvents and parts in relatively small quantities from retailers, and they manufacture items such as kitchen tools, car polish, iron work, plastics and jewelry.

3. ENTERPRISE BACKGROUND

PT FDK-Intercallin was established in 1990 and commenced operations the same year. It is a 46% Indonesian owned enterprise. The company employs 273 persons and produces AA alkaline batteries. In 1993, the company consumed approximately 32.4 MT of 111 TCA in the removal of stamping oil from nickel plated steel battery cases and brass battery parts. One employee per shift operates the 111 TCA cleaning line, which runs three shifts per day, 8 hrs./shift, 300 days per year.

4. PROJECT DESCRIPTION

4.1 PROCESS SOILS

Petroleum-based stamping oil is used to facilitate the stamping out of the battery cases from nickel plated steel (NPS) roll stock. Brass end caps and internal conductor pins are stamped out in a similar manner.

4.2 PRESENT PROCESS

To carry out the cleaning operation to remove the stamping oil described above, the enterprise uses a Fuji Electrochemical Co. Inc. V-2 in-line non-ultrasonic vapour degreaser from Japan. The unit is four years old and has been in use at PT FDK-Intercallin since the company was started. The overall dimensions (footprint) of the vapour degreaser are 1220 x 94 cm. This unit requires 8 drums of 111 TCA for operation.

The cleaned NPS cases are inspected visually to ensure that they are both dry and free from oil.

The brass parts are further washed in a Pakuna 100-MA line to complete the de-oiling, and further acid washed to produce the desired surface on the brass, then dried prior to visual inspection.

After cleaning and inspection, the battery cases are filled with the alkaline storage medium during the assembly operation.

4.3 PROPOSED ALTERNATIVE PROCESSES

The stamping oil would be removed from both the steel and the brass parts in an automated aqueous cleaning system.

The brass parts would then undergo washing in a secondary aqueous/ acid system to impart the desired surface characteristics.

The alkaline aqueous de-oiling system would be fitted with an oil separator, heated centrifugal driers and closed loop capability for the rinse water, while the brass treatment unit would require only the addition of a rinse water closed loop unit.

PT FDK - Intercallin has been testing an aqueous alkaline detergent system on the steel battery cases to determine if their entire production could be converted to this non-ODS process from 111 TCA. This test has been successful to date, demonstrating that such a process could eliminate at least 60% of ODS use at this enterprise. The next step is to scale up and show that the brass parts could also be successfully de-oiled in this system. This would eliminate the use of ODS at the enterprise. The test results to date show that the brass parts can be successfully de-oiled, provided they are given the secondary surface treatment.

These systems each require 7 litres/min water, which is in excess of the proposed new water regulations, which are evaluating whether to set the allowed water consumption at an upper limit of 0.3 litres/kg product.

Approximately 9.54 million steel and 19.1 million brass pieces would be cleaned per month, which is equivalent to 795 pieces/minute.

5. TECHNOLOGY

In the solvent sector, there are several options to the use of 111 TCA for metal cleaning:

- aqueous
- semi-aqueous
- non-ODS chlorinated solvents
- hydrocarbon solvents

PT FDK-Intercallin has chosen to use an aqueous process to eliminate all solvents from the factory. There is no problem with rusting of the non-nickel plated edges of the steel pieces, provided the drying step is carried out properly. This option permits the enterprise to continue operations without compromising their high quality standards after replacing their present 111 TCA degreaser, provided the water supply and disposal issues can be resolved.

6. PROJECT COSTS

6.1 TOTAL CAPITAL COSTS

The following summarizes the anticipated investment cost and related activities:

DESCRIPTION	SUB-TOTAL	TOTAL
· Aqueous Detergent Cleaning system	$360,000	
· Automated closed loop rinse water treatment system for de-oiling unit.	55,000	
· Automated closed loop rinse water treatment system for brass cleaning unit.	55,000	
· Oil separator and 2 centrifugal driers	140,000	
· Freight and Installation	47,000	

		$657,000
· Revision of water piping	20,000	
· Electrical wiring	20,000	
· Ventilation improvement	12,000	

		52,000
· Salvage		(2,000)
· Training & engineering		6,000
· Process & material compatibility testing		4,000
· Contingency & rounding		15,000

		$731,000

6.2 INCREMENTAL OPERATING COSTS

The following table summarizes the incremental operating cost:

ITEM	PRESENT TCA SYSTEM	PROPOSED AQUEOUS-DETERGENT CLOSE-LOOP SYSTEM
1) Solvent cost	$58,320 (32.4MT x $1.80)	$ 34,041 (7,167 kg/yr x $4.75)
2) Labour cost	$9,000	$27,000
3) Energy cost	$50,400*	$67,536**
4) Maintenance	$ 1,000	$ 8,500
Total	$118,720	$137,077

* ($0.14/KWH x 8hr/shift x 3 shifts/day x 300 x 50 KWA)

**($0.14/KWH x 8hr/shift x 3 shifts/day x 300 x 67 KWA)

Difference: $18 ,357

NPV of 4 Year Difference = 0.7925 x 62,357 x 4 = $58,192

6.3 UNIT ABATEMENT COST

- ODS reduction capital cost................USD 732,000
- Annual incremental costs ....USD 18,357
- Project useful life..10 years
- ODS reduction..32,400Kg
- Unit Abatement Cost [(a/c + b) /d] US/kg .... 13.1 ODP Basis)
  (adjusted for 46% local ownership)

7. FINANCING PLAN

The enterprise has elected to contribute $140,000 for the oil separator and centrifugal driers, so the net project cost is USD 732,000 +58,192 - 140,000 = 650,192. Adjusted for the 46% Indonesian ownership, the total would be: USD 249,100.

8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT

UNDP will oversee the completion of this project.

8.2 SCHEDULE

The project will be considered complete when monitoring has established the new process meets PT FDK-Intercallin's production and quality requirements plus all applicable waste water disposal regulations.

It will be carried out according to the schedule below

Time for Completion

	1994				1995			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Project Preparation				X				
MLF Approval				X				
Order Equipment				X	X			
Process Modification						X	X	
Installation						X	X	
Trial Runs							X	
Compatibility Test for customers							X	X
Training						X	X	X
Operation(routine monitoring shows parts are meeting customer needs)								X

9. PROJECT IMPACT

This project will eliminate the use of at least 32.4 MT of 111 TCA during the first year of implementation.

10. ENVIRONMENTAL ASSESSMENT

Under this project, PT FDK-Intercallin will convert to an aqueous detergent metal cleaning process for de -oiling and surface treating parts, which is technologically accepted world-wide. Since this is a metal cleaning process, removing processing oils (as opposed to removal of acidic flux residue), it is unlikely that this project will have an adverse environmental impact, provided the

. spent wash solution is properly concentrated prior to disposal of the resulting sludge
. oil from the oil separator is collected for proper disposal
. rinse water is recycled via a closed loop system.

THE NORRIS GROUP

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TECHNICAL REVIEW

I have reviewed the Indonesian Project, "Elimination of 1,1,1 TCA in the manufacture of nickel plated steel and brass AA battery parts at PT FDK-Intercallin", from the solvent sector, based on discussions with the author , as well as review of the document.

1	Country of Origin	Indonesia
2	Project Title	Elimination of 1,1,1 TCA in the manufacture of nickel plated steel and brass AA battery parts at PT FDK-Intercallin
3	Sector	Solvents
4	Relationship to C.P.	The project addresses how this enterprise ODS phase out fits in with the ODS using solvent subsectors in Indonesia. The project relates to the C.P. via the description of the solvents used and the amounts to be phased out, although It does not specifically write about the country programme.

5 Technology

Technical Soundness

This project substitutes effective ODS alternative technology choices for the solvent battery parts cleaning lines currently in use. It includes the installation of aqueous cleaning technology for removal of the soils and for brass surface treatment following the aqueous cleaning step.

The use of aqueous cleaning chemicals in the replacement technology choice will require the use of oil separation and water recycling to keep operating costs under good control and to meet new Indonesian regulatory requirements regarding water use. These are provided for in the project.

Safety

The use of aqueous cleaning chemicals is generally safer than the use of flammable and/or toxic substances, but aqueous detergents are still harsh chemicals in need of careful treatment to ensure safety in operation. Thus, in order to control acute exposure and the development of chronic exposure situations during routine operations, it is important that the use of protective equipment and handling procedures such as unloading, solution makeup, and waste transfer be spelled out; and people trained before they are permitted to become operators in the cleaning area. Periodic retraining is also recommended.

6 Environmental Impact

It is unlikely that this project will have an adverse environmental impact. The enterprise is capable of processing aqueous waste, and plans to treat the effluent from the proposed cleaning operation in a new system, which will be needed to meet new regulatory requirements associated with water consumption.

7 Project Costs

The cost components identified in the project cover the equipment required, including ventilation improvements, and those operational cost components needed to run safely and under adequate environmental control. The cost of safety training and ongoing updates of that training are not included. These costs are not normally considered to be major elements in a project, and would not normally change the project cost materially.

8 Implementation Timeframe

The proposed implementation timeframe is feasible from an elapsed time standpoint. The actual date of startup, however, will be dependent upon the approval date.

9 Recommendation

The project is sound, needed, and has a level cost effectiveness - about $93/Kg ODP - which is very good for the phase out of TCA. This very good level of cost effectiveness is partially due to the fact that the enterprise is willing to pay a portion of the total cost of the project. Approval as proposed is recommended.

CLINTON NORRIS

Clinton Norris

19 October 1994

INS.03

PROJECT COVER SHEET

COUNTRY:	Republic of Indonesia
PROJECT TITLE:	Elimination of the use of CFC-113 in the manufacture of metal personal headphone parts at PT Padma Pacific Sejahtera.
SECTOR COVERED:	Solvent
ODS USE IN SECTOR: (1992 basis)	160 MT of CFC-113 2198 MT of 1,1,1, Trichloroethane 115 MT of Carbon Tetrachloride 474 MT of ODP weighted consumption
PROJECT IMPACT:	1.5 MT/yr of CFC-113
PROJECT DURATION:	18 months
PROJECT USEFUL LIFE:	10 years
TOTAL PROJECT COSTS:	Total capital investment cost: USD 164,000 NPV of incremental operating cost savings: USD -13,790
PROPOSED MLF GRANT:	USD 150,210
COST EFFECTIVENESS:	USD 8.4 \$/kg Unit Abatement and \$104/kg C.E. ratio
NATIONAL COORDINATING AGENCY:	Indonesia Ministry of Environment (LH)
IMPLEMENTING AGENCY:	UNDP

PROJECT SUMMARY

This project will eliminate the use of CFC-113 and in the cleaning of stamped metal personal headphone parts at PT Padma Pacific Sejahtera. The company is a 100% locally owned enterprise providing personal stereo headphones and optical pickups for CD players. PT Padma Pacific Sejahtera also produces plastic clothes hangers and cosmetic packaging. The majority of the parts are exported, with Sony being the sole customer for the electronic goods. PT Padma Pacific Sejahtera manufactures the parts from galvanized steel sheet. The phaseout will be accomplished by replacing the current CFC-113 vapour degreasing process with a non-ODS chlorinated solvent process.

PROJECT OF THE GOVERNMENT OF INDONESIA:

ELIMINATION OF THE USE OF CFC113 IN THE MANUFACTURE OF METAL AND PERSONAL HEADPHONE PARTS AT PT PADMA PACIFIC SEJAHTERA.

1. PROJECT OBJECTIVE

The objective of this project is to phase out the use of all ozone depleting solvent metal parts cleaning processes at PT Padma Pacific Sejahtera.

2. SECTOR BACKGROUND

The ODS consumption in the Indonesian solvent sector is estimated to have reached 115 MT of carbon tetrachloride, 160 MT of CFC-113 and 2198 MT of 111 TCA in 1992. This sector represents the largest use of ODS - 31% of the total consumed in that year. On an ODP basis, the total solvent consumption was 474 MT, or 7.22% of the total consumed by the country. The sector has increased rapidly, primarily as a result of the expansion of the electronics and metal cleaning industries through investment in joint ventures.

The metal cleaning processes account for approximately 50% of the total consumption of the solvent section in Indonesia. This subsector includes most gross cleaning processes of large or heavily soiled parts, and can be found in industries such as transportation, shipyard, basic metal, and machinery. The electronic cleaning processes include the cleaning of printed circuit boards, electronic parts cleaning, and the cleaning of electronic board assemblies after soldering.

A large number of companies use ODS in small quantities, but their number is unknown, because while some register as businesses, many do not. These companies generally buy their solvents and parts in relatively small quantities from retailers, and they manufacture items such as kitchen tools, car polish, iron work, plastics and jewelry.

3. ENTERPRISE BACKGROUND

PT Padma Pacific Sejahtera was established in 1985 and commenced operations the same year. It is a 100% Indonesian owned enterprise. The company employs 700 persons (600 direct and 100 indirect) and produces both metal and plastic parts for the electronics, clothing and cosmetic industries. Sony is the single major customer for the electronics products, taking 90% of PT Padma Pacific Sejahtera's output. In 1993, the company consumed approximately 1.5 MT of CFC-113 in the removal of stamping oil from metal parts. Three employees plus one leader comprise the cleaning team, which works one shift per day, 264 days per year.

4. PROJECT DESCRIPTION

4.1 PROCESS SOILS

BP Glora 211 stamping oil is used to facilitate the stamping out of the headphone parts from 72 mm wide galvanized ferrous alloy roll stock.

4.2 PRESENT PROCESS

To carry out the cleaning operation to remove the stamping oil described above, the following steps are employed in a San Rex SL3-46E three sump ultrasonic vapour degreaser from Japan. Each of the three steps in the wash/rinse/vapour dry cleaning cycle takes 5 minutes.

The parts are cleaned in a 250 x 350 x 200 mm steel basket, which is extensively drilled to facilitate drainage. Each basket load is ca. 1000 pieces, equivalent to 3-4 kg., which is about 20% of the basket's capacity. Approximately 1.3 MM pieces are cleaned monthly in this machine, which is equivalent to 14,400 kg. of parts/yr. .

After cleaning, the metal parts are assembled into the plastic headset shell.

The cleaning process also serves as the cleanliness test; i.e. if the process is followed exactly then the parts will be clean enough for the post assembly processes which result in the completed high quality personal stereo headphones.

4.3 PROPOSED ALTERNATIVE PROCESSES

PT Padma Pacific Sejahtera has elected to do a two-step conversion to a non-ODS process. The first step was to test 111 TCA in the present degreaser to determine if it would remove the stamping oil to meet quality standards. This was feasible since it presented minimal exposure hazard to the workers. If this is achievable, then the second step will be to convert to trichloroethylene (TCE), a non-ODS chlorinated solvent. Since the present degreaser cannot be retrofitted to meet the much more stringent vapour emission levels allowed for TCE, it will have to be replaced with one specifically designed for this solvent. In addition, an exhaust system, with associated blowers and ducts to the outside of the building, is required.

5. TECHNOLOGY

In the solvent sector, there are several options to the use of CFC-113 for metal cleaning:

- aqueous (employs detergents and water rinses to achieve cleanliness)
- semi-aqueous (uses solvents and water rinses to achieve cleanliness)
- non-ODS chlorinated solvents
- hydrocarbon solvents

The company has chosen to use a non-ODS chlorinated solvent process because the parts must emerge dry and oil-free. Aqueous or semi-aqueous processes were not considered since the galvanized iron alloy parts have exposed iron edges after stamping that would rust very easily. This option permits PT Padma Pacific Sejahtera to continue operations after replacing their present degreaser and adding an exhaust capability to maintain the solvent-in-air levels within the range generally accepted as consistent with good workplace practice.

6. PROJECT COSTS

6.1 TOTAL CAPITAL COSTS

The following summarizes the anticipated investment cost and related activities:

DESCRIPTION	SUB-TOTAL	TOTAL
· Non-ODS Chlorinated Solvent (TCE) Cleaning system	$85,000	
· Automated hoist system to minimize worker exposure to TCE vapors	20,000	
· Freight and Installation	15,000	

		$120,000
· Solvent vapour level in workplace air monitoring system	13,000	
· Electrical wiring	3,000	
· Ventilation improvement	4,000	

		20,000
· Salvage		(1,000)
· Training & engineering		6,000
· Process & material compatibility testing		4,000
· Contingency & rounding		15,000

		$164,000

6.2 INCREMENTAL OPERATING COSTS

The following table summarizes the incremental operating cost:

ITEM	PRESENT SYSTEM	PROPOSED NON-ODS CHLORINATED SOLVENT SYSTEM
1) Solvent cost	\$ 6,600 (1.5MT x \$4.40)	\$ 2,250 (1.5MT x \$1.50)
2) Labour cost	\$10,560	\$10,560
3) Energy cost	\$ 748.80 (\$0.06/hp x 8/day x 312 x 5hp)	\$ 748.80 (\$0.06x 8x 312 x 5)
4) Maintenance	\$ 1,000	\$ 1,000
Total	\$18,908.80	\$14,558.80
Difference	\$4350	

NPV of 4 Year Difference = 0.7925 x 4350 x 4 = \$13,790

6.3 UNIT ABATEMENT COST

- ODS reduction capital cost................USD 164,000
- Annual incremental cost savings...........USD (4,350)
- Project useful life............................10 years
- ODS reduction....................................1,500Kg

. Unit Abatement Cost [(a/c + b) /d] US/kg/ 9.9 (ODS Basis)

7. FINANCING PLAN

The company requests reimbursement of the complete project costs, which are estimated to be: USD 164,000 + (13,790) = 150,210

8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT

UNDP will oversee the completion of this project.

8.2 SCHEDULE

The project will be considered complete when monitoring has confirmed that production volumes and cleanliness levels of parts either exceed or are equivalent to the CFC-113 process and the TCE levels in the workplace air are in compliance with generally recognized standards. It will be carried out according to the schedule below

Time for Completion

	1994		1995					1996
	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
Project Preparation		X						
MLF Approval			X					
Order Equipment			X	X				
Process Modification				X	X			
Installation					X	X		
Trial Runs						X		
Compatibility Test for customers					X	X		
Training					X	X	X	
Routine production, monitoring shows parts are meeting customer needs								X X

9. PROJECT IMPACT

This project will eliminate the use of at least 1.5 MT of CFC-113 during the first year of implementation.

10. ENVIRONMENTAL ASSESSMENT

Under this project, PT Padma Pacific Sejahtera will convert to a non-ODS chlorinated solvent (TCE) system which is technologically accepted world-wide. Since this is a metal cleaning process, removing processing oils (as opposed to removal of acidic flux residue), it is unlikely that this project will have an adverse environmental impact, provided the spent solvent is properly collected for recycle and proper disposal of the resulting sludge.

THE NORRIS GROUP

303 WEST LOCUST LANE
KENNETT SQUARE, PA 19348

TECHNICAL REVIEW (610) 444-9058

I have reviewed the Mexico Project, "Elimination of the use of CFC-113 in the manufacture of metal personal headphone parts at PT Padma Pacific Sejahtera.", from the solvent sector, based on discussions with the author , as well as review of the document.

1 Country of Origin — Indonesia

2 Project Title — Elimination of the use of CFC-113 in the manufacture of metal personal headphone parts at PT Padma Pacific Sejahtera.

3 Sector — Solvents

4 Relationship to C.P. — The project addresses how this factory ODS phase out fits in with the ODS using solvent subsectors in Indonesia. The project relates to the C.P. via the description of the solvents used and the amounts to be phased out.

5 Technology

Technical Soundness

This project will eliminate the use of CFC-113 cleaning of galvanized steel, personal headphone parts at PT Padma Pacific Sejahtera which, before cleaning and after stamping, have sharp exposed edges of oxidizable steel. The phaseout will be accomplished by replacing the current CFC-113 vapour degreasing process with a non-ODS chlorinated solvent process.

This project substitutes effective ODS alternative technology for the CFC 113 solvent cleaning operation to be replaced. It includes the process definition, qualification, and installation of cleaning technology that will meet the requirements of cleaning fthese small stamped parrts, as described in the document.

The use of chlorinated solvent in the replacement technology choice will somewhat restrict the equipment choices, due to the need to maintain safe exposure levels, but this equipment can be effective and can be used safely if appropriate procedures are followed. The equipment must be reasonably vapor tight, with appropriate venting technology. The need for safe operating equipment is specifically recognized in the project.

Safety

The use of potentially toxic solvents must provide for low exposure levels, both acutely and chronically. Thus, in order to control exposure and the creation of hazardous potential exposure levels during routine functions, it is important that handling such as loading, unloading, solution makeup, and solvent transfer procedures (including spent materials) be spelled out and people trained before they are permitted to become operators in the cleaning area. Periodic retraining is also recommended.

Provisions for safe maintenance must also be made, e.g. the use of appropriate and proper protective equipment before entering the cleaning basket area of the equipment.

6 Environmental Impact

It is unlikely that this project will have an adverse environmental impact since the equipment includes vapor recycling to minimize waste. However, even with waste minimization, there will still be waste drums, and there will still be a need for these drums to be sent to reliable waste recovery and disposal/destruction operating companies.

7 Project Costs

The cost components identified in the project cover the equipment required, including ventilation improvements for exposure control, and operational cost components needed to run safely and under adequate environmental control. The cost of safety training and ongoing updates of that training are not included. These costs are not normally considered to be major elements in a project, and would not normally change the project cost materially.

8 Implementation Timeframe

The proposed implementation timeframe is feasible from an elapsed time standpoint. The actual date of startup, however, will be dependent upon the approval date.

9 Recommendation

The project is sound, needed, and has a level of unit abatement cost - about $8.4/Kg. ODS and a cost effectiveness ratio of $104/kg that is acceptable. Approval is recommended, with the proviso that the safety and environmental issues will be addressed.

CLINTON NORRIS

20 October 1994

THE NORRIS GROUP

303 WEST LOCUST LANE
KENNETT SQUARE, PA 19348

TECHNICAL REVIEW (610) 444-9058

I have reviewed the Indonesia Project, "Elimination of the use of CFC-113 in the manufacture of metal personal headphone parts at PT Padma Pacific Sejahtera.", from the solvent sector, based on discussions with the author , as well as review of the document.

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Clinton Norris

CLINTON NORRIS

20 October 1994

The Montreal Protocol on Substances that Deplete the Ozone Layer
Indonesia ODS Phaseout Project

Project Cover Sheet

COUNTRY :	Republic of Indonesia
PROJECT TITLE :	Reduction of CFC-12 Emission During Service of Mobile Air Conditioners by Use of Recycling Equipment.
SECTOR COVERED :	Mobile Air Conditioning
ODS USE IN SECTOR :	Approximately 1,436 MT of CFC-12 Used During Installation and Servicing of MACs, of which 84.3% (1,211 MT) Used for Servicing.
PROJECT IMPACT :	Phase 1 : Reduction of 40.95 MT of CFC-12 (40.95 ODP-weighted MT) per year Phase 2 : Reduction of 262.08 MT of CFC-12 (262.08 ODP-weighted MT) per year
PROJECT DURATION :	4 years
PROJECT ECONOMIC LIFE :	7 years
TOTAL PROJECT COST :	ODS Reduction Investment Costs : US$ 1,585,900 Incremental Operating Costs : US$ 574,210 Total Project Costs : US$ 2,160,110
COST - EFFECTIVENESS :	Phase 1 : US$ 3.27 / ODP-weighted kg ODS saving Phase (1+2) : US$ 2.22 / ODP-weighted kg ODS saving
PROPOSED OTF FINANCING : 1)	Phase 1 : US$ 603,550 as a grant Phase (1+2) : US$ 2,558,650 as a grant
IMPLEMENTING ENTERPRISE :	PT Nippondenso Indonesia, Inc.
COORDINATING MINISTRY :	Indonesia Ministry of Environment (LH)
IMPLEMENTING AGENCY :	The World Bank

PROJECT SUMMARY

The objective of this project is to reduce emissions of CFC-12 during the servicing of MACs by installation of recycling equipment at multiple service shops. The project would be under the management of a single entity, Nippondenso, and will rely upon a relatively simple structure so as to maximize effective use of recycling equipment in the field. Practical implementation issues will be identified during a pilot phase in which 50 recycling machines will be installed and resolved prior to full scale implementation in which another 320 machines are installed. Ongoing training, support, and equipment maintenance will be provided to MACs service shops by Nippondenso. Nippondenso will own the recycling machines and will lease them at a modest rate to the service shops.

TECHNICAL ASSESSMENT

This project concept is being submitted to OORG reviewer for final approval. The reviewer's concerns about the incentives facing service shops, the possibility of including other sectors in the recycling scheme and the budget for training and program promotion have been addressed.

1) including 15 % contingency and 3 % financing agent fee.

PROJECT OBJECTIVE

The objective of this project is to reduce emissions of CFC-12 during the servicing of MACs by installing recycling equipment at multiple service shops.

SECTOR BACKGROUND

At present there are appoximately 2.6 Million vehicles in Indonesia. Approximately 50% or 1.3 million of the vehicles have MAC units installed, all of which use CFC-12 as the refrigerant. The charge used for both services of repairing and new installation is about 1,436 MT CFC-12 yearly. Of this amount 84.3 % is used for servicing or repairing and 15.7 % for new installation.

The Country Programme indicates only 200 shops in Jakarta but by our more accurate survey over a national range, it was estimated about 1,370 service shops spread across the country. These service shops are categorized as follows: small service shops (0-3 vehicles per day), medium service shops (4-9 vehicles per day) and big service shops (above 10 vehicles per day), which about 400 service shops are located in Jakarta. All the service shops employ in the order about 6,850 people, many of them have not received formal training. Most of the service shops are independently owned and operated, and some of them are organized into groups.

There are three manufacturers of MACs in Indonesia, they are Nippondenso, Sanden Jaya Indonesia, and Thermo Asri Makmur. Nippondenso Indonesia has 31 authorized servicing outlets that also sell MACs spare parts to other service shops. Sanden Jaya Indonesia has about 17 outhorized service outlets operating similarly under independent distributors. Thermo Asri Makmur is specialized for buses and trucks, this company is a sole agent of Thermo King USA.

Nippondenso has a service network with strong coordination between parts supplier and distributors due to technology information system such technical information, repair manual, and technical training course. Sanden Jaya Indonesia has a distributor system but does not have an organized service network. MACs appear to have been introduced in Indonesia in the late 1970's and presumably, servicing of MACs began around the same here.

Basically Thermo Asri Makmur only has official dealers, but does not have an organized service network.
Attachment 1 included a detailed profile of the MACs service sector in Indonesia.

This project is consistent with the country program - chapter 3. It is expected that an additional project requesting funding for converting factories manufacturing CFC-12 to HFC-134a equipment will be submitted at a later date.

ENTERPRISE BACKGROUND

Nippondenso holds about 80% of market share for MACs, with sales in 1993 is 84,690 units of MACs. This company assemblies MACs in house as CKD (Complete Knock Down) and a part of its components are produced locally

under authority of Nippondenso Co. Ltd. Japan.
Capital shares is owned by:

1. Astra International (Indonesia)	25.5 %
2. Multi Invest (Indonesia)	25.5 %
2. Nippondenso Co. Ltd, Japan	45 %
3. Toyota Tsusho Co. Ltd, Japan	4 %

Both factory and headquarter are located in the same address, Jl. Gaya Motor 1 No. 6, Sunter II, Kelurahan Sungai Bambu, Tanjung Priok - Jakarta 14330.

Nippondenso Indonesia was established in 1975 and first introduced Nippondenso MACs in Indonesia in 1978. As mentioned above, Nippondenso has 31 service shops outlets and Nippondenso at present employes of 863 people. For the time being, Nippondenso has allocated 45 units of recovery and recycling machine (R/R machine) to it is service shops and 4 units are being retained by Nippondenso in it is factory. These Nippondenso's R/R machines have operated since 1991. The mechanics in all of its dealers have been trained about how to operate this machine. The relationship between Nippondenso and dealers/distributors is by authorized working agreements.

Nippondenso has begun to replace the new MACs installation with non-ODS, and by the end of 1995 Nippondenso anticipate that all of the new MACs will already use non-ODS.

PROJECT DESCRIPTION

To fulfill the project objectives outlined above of reducing emmissions and prolonging the availability of stocks of recycled CFC-12, a cost effective scheme for maximizing recycling of it at the service station level is proposed. There must be a commercial incentive at the service station level for the scheme to succeed. The service of recovering and recycling is charged to the mobile air condition user in addition to the cost of any fresh CFC used. This represents a saving or reduction in the use of new CFC-12. The service stations would have to pay a fixed rental for the recycling machines plus the cost of electricity and labour to operate them. It is estimated that the profit generated from the difference between these costs and the revenue generated can be appreciable for the service outlets particularly with the rising cost of CFC-12 in the future.

For the project to be successful it is necessary for one organization to be selected - Nippondenso, to coordinate and control the distribution and usage of the recycling equipment. This company would receive a grant from the Multilateral Fund to purchase the equipment. They would also have the responsibility to provide the service stations with training in the use of the equipment and for any maintenance required. This company has been selected since it controls approximately 80% of the local market and because of the lack of other suitable organizations.

Nippondenso has already on its own initiative purchased 49 recycling machines and distributed 45 of these in its network of service stations providing them with the necessary training in usage. They also have provided the required maintenance. Nippondenso has further indicated that they are interested in assuming this position. While they do not consider the activity as an appreciable profit centre they never the less naturally wish to cover their costs which is not possible from the rental on the machines. The four machines retained by Nippondenso were used as spares. At present three machines in operation at the service shops have had to be replaced. These three returned machines have been used for spare parts, thus at present only one spares remain.

The 1st phase of this project is essentially a pilot scheme with a grant for the purchase of 55 recycling machines by Nippondenso with distribution of 50 of these machines by them to suitable service stations. The distribution of new machines will be to all mobile air conditions shops and not just only to those affiliated to Nippondenso. For the first phase, the project will cover 5 cities in Java (Jakarta, Bandung, Surabaya, Semarang and Yogyakarta). Records must be kept at all times by the service stations and compiled by Nippondenso. On the basis of these records giving costs, the number of cars serviced, the CFC-12 recovered and recycled an assessment can be made of the viability of the project. The second phase of this project is for the purchase of at least another 330 recycling units and distribution of 320 of these machines throughout major urban areas in Indonesia.

The selection of the shops to receive machines under this program would be based on the SUCOFINDO survey as a starting point with additional surveys with Nippondenso as the scheme develops. If service shops do not operate correctly in the scheme then Nippondenso will remove the recycling unit and give it to another more active service shop.

JUSTIFICATION FOR NOT SELECTING ALTERNATIVE PROGRAM DESIGNS

The accompanying financial assessment and in particular the unit abatement cost indicates that this project proposal is very cost effective. Other systems such as a central reclamation unit would prove very much more expensive and probably ineffective in operation due to the wide dispersion of the garage service shops (see Attachment 2 for more details).

The proposed system is ultimately compatible with the change over of MACs from CFC-12 to HFC-134a. True the recycling machine would have to be changed, however the organization and habit will have been established for recovering and recycling the HFC-134a which has an appreciable global warming potential. The three manufacturers of MACs in Indonesia are at present initiating the conversion of their units to HFC-134a and consider that by end 1995 only the new models will be produced. Any funding for these conversions could only be made retroactively. The research and development is mainly Japanese though some of the conversion costs will have to be bourne by the Indonesian parties.

The incentive to the service shops should amount on an average about US$125 per month per shop after deducting rental, labour costs and electricity to charges. The recycling equipment rental is set at US$10 per month to allow a reasonable incentive for smaller service shops. These incentives are considered sufficient by Nippondenso to make the scheme viable.

PROJECT COSTS

As described below, and detailed in the relevant annexes, the total project cost (investment costs and recurring operating costs) over the first four years of the project is US$ 2,160,110 Funding from OTF is requested for phase 1 is US$ 603,550, and if phase 2 is conducted the total funding for phase (1+2) is US$ 2,558,650. This includes support for both phases of the project with the recommendation that the grant for the second phase not be disbursed until the appropriate implementing agencies have concurred that the pilot phase had been successful. All financial calculation are shown in Annex 1, Annex 2, and Annex 3.

Investment Costs of US$ 1,585,900 are detailed in Annex 1. Phase 1 investment costs are US$ 244,200, phase 2 investment costs are US$ 1,341,700 and investment cost for phase (1+2) is US$ 1,585,900.

The cost for each recycling machine includes an extra gas bottle for the scheme to run smoothly.

Net Incremental Operating Costs of US$ 574,210 are equal to the net present value of the first four years of incremental operating costs. The net incremental operating costs in Phase 1 are US$ 265,340 for four years and US$ 373,750 per year during two years in Phase 2. A more detailed breakdown of the operating costs and the assumptions used for each year of the project are provided in Annex 2. Nippondenso incurs operating cost for technicians, travel by technicians, and truck rental. The project reinburses Nippondenso for these costs.

Other Costs. A 15% contingency (US$ 324,050) was also included to ensure adequate funding of project costs following project appraisal. An additional US$ 74,550 (3%) was added to the grant request to cover the fee for services of the financial institution (FI) that will appraise the projects and oversee procurement, disbursement and supervision.

Requested Funding. The proposed OTF grant for Nippondenso are Phase 1 US$ 603,550, and for phase (1+2) is US$ 2,558,650, and was calculated as follows: for the phase 1 the present value of the net incremental costs for four years of the project were added to the phase 1's investment costs. This figure was increased by a 15 percent contingency to yield the grant amount. Finally, this figure was increased by 3 percent to account for the financial institution fee. Despite the fact that Nippondenso has 49% foreign ownership, the proposed grant amount has not been reduced. This approach has been taken for two reasons. First, despite the fact that the direct beneficiary, Nippondenso, has foreign ownership, the ultimate beneficiaries are the service shops which are all locally owned. Second, were the grant to be reduced, it would cause the project to be an unprofitable one for Nippondenso (i.e., it would have a negative net present value). Since Nippondenso is expected to earn only a very modest return on this project, reduction of the grant was deemed inappropriate.

Attention is drawn to Nippondenso having already purchased and distributed to various service stations 45 Mobile Air Conditions recycling machines. The documented cost for these machines is US$ 129,300 (copies of the relevant invoices are included with part II page 20 of the attachments. Nippondenso purchased three models of Robinair machines for trial purposes. On the basis of this they selected the model no. 17501 with attachments as the most suitable for use in Indonesia. The bulk of the 49 machines they purchased were model no. 17501 even though more expesive. The cost of this machine was US$ 3,700 CIF Indonesia

UNIT ABATEMENT COST (UAC)

As derived in Annex 3, the UAC calculated over the four years life of the project is US$ 3.27 per ODP-weighted kg of CFC-12 in phased 1 and US$ 2.22 per ODP-weighted kg of CFC-12 in phase (1+2). This number is derived from the incremental annualized capital costs of US$ 50,160 and the net annualized incremental operating costs of US$ 83,710 with average annual savings of phase 1 is 40.95 MT of CFC-12. In phase (1+2), 228.15 ODP-weighted MT is saved which annualized investment cost of US$ 325,750 and annualized operating cost of US$ 181,150. The quantity recovered in the later years of the project may be somewhat less than this amount because of the growing penetration of HFC-134a into the Indonesian automotive fleet.

REQUIRED REGULATORY ACTIONS

At present, the Government of Indonesia levies varying duties on imported equipment. Because duties and taxes are considered transfer payments between organizations rather than true economic costs, the Multilateral Fund does not consider such costs as incremental. Hence, in order to reduce the total costs incurred by Nippondenso, it is recommended that the Indonesian government waive the import duty for all MACs recycling equipment supplied for this project.

In addition, to further strenghten the incentives for MACs service shops to participate in the project, it is recommended that the Government consider some form of regulation that would require use of CFC-12 recycling machines by, perhaps, the largest of the service shops.

RESULTS

This project will eliminate the use of 40.95 MT of CFC-12 per year during Phase 1 and 262.08 MT of CFC-12 per year during the five years of the second phase. It is anticipated that, as CFC-12 MACs are retired over time, and are not replaced by new CFC-12 MACs, the quantity of CFC-12 used will decline. An additional benefit is that the project will foster the technical and institutional capabilities needed for recycling of HFC-134a.

SCHEDULE

Task	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
Recruit Participating Shops	x	x						
Acquire recycling machines	x	x						
Undertake recycling			x	x	x	x	x	x
Conduct evaluation							x	x

ANNEX 1
Investment Cost

Phase 1

55 Recycling Machines (with spare parts) + Extra Bottle @ US$3,700	US$	203,500
Recruiting and Delivery to the service shops (55 machines) *)	US$	14,651
Service of Truck	US$	23,256
Workshops Training	US$	2,791

Phase 2

330 Recycling Machinse (with spare parts) + Extra Bottle @ US$ 3,700	US$	1,221,000
Recruiting and Delivery (330 machines) **)	US$	80,698
Service of Truck	US$	23,256
Workshops Training	US$	16,744

INVESTMENT COST PHASE 1	US$	244,198
ANNUALIZED INVESTMENT COST PHASE 1 (10%,7 YRS)	US$	50,160
INVESTMENT COST PHASE 2	US$	1,341,698
ANNUALIZED INVESTMENT COST PHASE 2 (10%,5 YRS) ***)	US$	275,592
TOTAL INVESTMENT COST	US$	1,585,895
NVP OF INVESTMENT COST	US$	325,752

*) Five being retained as spares by Nippondenso
**) Ten being retained as spares by Nippondenso
***) The NPV for Phase 2 has been calculated on the basis of 5 years since it is not forseen that the total life of the project is likely to exceed 7 years in total (Phase 1 + Phase 2) few if any CFC-12 MACs are likely to be in existence beyond

Costing Break Down
For MACs Project

Investment Cost (US$)
Phase 1

1. R/R Machines + Extra Bottle
   - US$ 3,700/Pc
   - US$ 203,500/55Pcs

2. Recruiting and Delivery
   Recruiting for 5 cities
   - Rp 4,300,000 X 5 : 2,150 = US$ 10,000
   Delivery
   - Rp 200,000 X 50 : 2,150 = US$ 4,651

3. Service Truck and Tool
   - Rp 50,000,000 : 2,150 = US$ 23,256

4. Trainning for one Manager
   - Rp 6000,000 : 2,150 = US$ 2,791

Phase 2

1. R/R Machines + Extra Bottle
   - US$ 3,700/Pc
   - US$ 1,221,000/330Pcs

2. Recruiting and Delivery
   Recruiting for 25 cities
   - Rp 4,300,000 X 25 : 2,150 = US$ 50,000
   Delivery
   - Rp 200,000 X 330 : 2150 = US$ 30,698

3. Service Truck and Tool
   - Rp 50,000,000 : 2,150 = US$ 23,256

4. Workshop Trainning (18 cities, 18 days)
   - Rp 2000,000 X 18 : 2,150 = US$ 16,744

ANNEX 2
INCREMENTAL OPERATING COST (US$)

Description		Year 1	Year 2	Year 3	Year 4
Phase 1					
Cost For Nippondenso:					
Labor Cost		62,532	62,532	62,532	62,532
Travel Cost		7,429	7,429	7,429	7,429
Annual Cost of Truck		3,000	3,000	3,000	3,000
Part Cost (e.g., Filters)		16,744	16,744	16,744	16,744
Rental Fee		(6,000)	(6,000)	(6,000)	(6,000)
Operating Cost		83,705	83,705	83,705	83,705
Total Operating Cost	334,821				
Net Incremental Operating Cost	265,334				
Net Annualized Operating Cost	83,705				
Phase 2					
Cost For Nippondenso:					
Labor Cost				125,724	125,724
Travel Cost				14,858	14,858
Annual Cost of Truck				6,000	6,000
Part Cost (e.g., Filters)				107,163	107,163
Rental Fee				(38,400)	(38,400)
Operating Cost				215,345	215,345
Total Operating Cost	430,690				
Net Incremental Operating Cost	373,739				
Net Annualized Operating Cost	215,345				
Phase (1+2)					
Operating Cost		83,705	83,705	299,050	299,050
Total Operating Cost	765,511				
NPV of Net Incremental Op. Cost	574,210				
(discount rate 10%)					
Net Annualized Operating Cost	181,146				

Costing Break Down
For MACs Project

Operating Cost (US$)

Phase 1

1. Part and Filter		
- Rp 60,000 X 50 X 12 : 2150	= US$	16,744
2. Labour		
- One Trainer/Manager	= US$	2,857/month
- One Repairman	= US$	1,429/month
- One Clerical	= US$	925/month
Total	= US$	5,211/month
	= US$	62,532/year
3. Travel		
- Trainer/Mgr-Travel days/year		36 days
- Repairman-Travel days /year		120 days
Total days of travel		156 days
- Daily travel cost	= US$	47,62
Total travel cost	= US$	7,429
4. Annual Cost of Trucks		
- Miles per year		20,000 miles
- Cost per mile	= US$	0.15
Total Annual Cost of Truck	= US$	3,000
5. Rental Fee		
Rp 21,500 X 50 : 2,150	= US$	500/month
	= US$	6,000/year

Phase 2

1. Part and Filter		
- Rp 60,000 X 320 X 12 : 2150	= US$	107,163
2. Labour		
- One Trainer/Manager	= US$	2,857/month
- Four Maintenance Personal	= US$	5,716/month
- Two Clerical	= US$	1,904/month
Total	= US$	10,477 /month
	= US$	125,724/year
3. Travel		
- Trainer/Mgr-Travel days/year		36 days
- Repairman-Travel days /year		120 days
Total days of travel		156 days
- Daily travel cost	= US$	47.62
Total travel cost	= US$	7,429
4. Annual Cost of Trucks		
US$ 3,000 X 2	= US$	6,000
5. Rental Fee		
Rp 21,500 X 320 : 2,150	= US$	3,200/month
	= US$	38,400/year

ANNEX 3
UNIT ABATEMENT COST (US$)

1	Phase 1		
	CFC-12 saved *)	MT	286.65
	Average CFC-12 saved	MT	40.95
	Incremental Invesment Cost	US$	244,198
	Net Inc. Operating Cost	US$	265,334
	Net Annualized Investment Cost	US$	50,160
	Net Annualized Operating Cost	US$	83,705
	UAC (US$/ODP-weighted kg ODS saving)		3.27
2	Phase 1+2		
	CFC-12 saved **)	MT	1,140.75
	Average CFC-12 saved ***)	MT	228.15
	Incremental Invesment Cost	US$	1,585,895
	Net Inc. Operating Cost	US$	574,210
	Net Annualized Investment Cost	US$	325,752
	Net Annualized Operating Cost	US$	181,146
	UAC (US$/ODP-weighted kg ODS saving)		2.22

*) Calculated as follow : 40.95 MT/year x 7 years
The number of 40.95 MT/years is the amount of CFC-12 saved by 50 R/R machines

**) Calculated as follow : 228.15 MT/year X 5 years

***) Calculated as follow : (40.95 MT/year x 7 years + 262.08 MT/year x 5 years)/7
The number of 262.08 MT/year is the amount of CFC-12 saved by 320 R/R machines

ATTACHMENT 1

Profile of the MACs Service Sector in Indonesia

The methodology use by Sucofindo in this collection of data on MACs service shops consisted of:

1. Dividing the towns concerned into convenient sectors (access by transportation from central office)
2. Sampling was made within these sectors of the service shops.
3. With the selection of bigger shops being located first and followed by medium and small. This was in order to find out at the beginning of each sector if any recovery system was in operation which would only be with bigger shops. This would enable checking out any collaboration with small and medium shops when we visited the latter.
4. Service shops in Indonesia are easily located since they all consist of:
   a. Spare part dealers.
   b. General repair shops.
   c. Have notices displaying A/C mobile, Nippondenso, Sanden or Thermo king often all three.
   d. Cylinders of CFC-12 and pressure guages are readily visible.
5. At each MACs service shops located the following questions were asked:
   a. Company information, name, address, resposible person.
   b. The information contained in attachment 3.
   c. Whether any recycling was carried out at present
   d. Whether they were interested in using such equipment if made available on a rental basis
   e. Whether they were aware of the need to phase out ODS both for themselves and their children

The results of the questionare were verified by cross checking the information received from the respective service shops with one another and with Nippondenso, Sanden, and Thermo King.

ATTACHMENT 2

Detailed Project Description

1. Objectives : to recover as much as possible of the CFC-12 from the automobile air conditioners being serviced by using recycling equipment; at present most is being vented into the atmosphere.

2. To perform the recycling the necessary equipment would have to be supplied to the servicing station on a rental basis (since many of the shops do not have the ready capital available)

3. Training on operation and maintenance of the recycling equipment would have to be supplied and one centralized organization would receive the grant and control the project. A minimum number of 2 - 3 personnel would have to be trained from each service shop.

   The scheme was put forward on the basis of the large number of MACs using CFC-12 which would either have to be supplied with fresh CFC-12 to cover the life of the MACs or they would have to be retrofitted which is not considered feasible or saleable to the MACs owners in Indonesia.

4. The recovering and recycling of the CFCs by the service stations would be charged the MAC owners. This would offset to some extent the use of new CFC-12. This would provide a revenue to the service shops which should lead tó a reasonable profit margin after payment of electricity and labour costs in recycling

   The wear on the MACs in Indonesia with the heavy usage throughout the year is appreciable. This was one of the reasons for selecting the life of this MACs project of 7 years, by which time it is considered that most MACs using CFC-12 will have been phased out. The second reason for selecting 7 years is that there is some doubt whether the recycling machines will last longer than this time under the tropical conditions at the service stations.

5. The service stations would be expected to keep records of the number of MACs serviced and of the amount of CFC-12 recovered and recycled with costs of electricity, labour (recovery and refill) plus the amount charged to MACs owner for recovery and recycling.

   The distances in Indonesia are very large, from one end (Irian Jaya) to the other (Aceh) is roughly equivalent to Los Angeles to New York. A string of islands without an intervening land mass. To have a centralized system of recovery, recycling or reclamation would still require many large units on each major island which is considered very expensive and difficult to practically operate.

   It was on this basis the present scheme was proposed :

   a. Many smaller less expensive recycling machine widely dispersed throughout Indonesia.
   b. Some measure of local collection within relatively limited areas is forseen. The general public including the service shops visited are aware of the ozon depletion problem (TV, Newspapers etc.) and express a concerned wish to cooperate.

c. For the Scheme to work it is foreseen that there must be reasonably, profitable financial incentives for the service shops and the MACs owners. For the service shops this would be provided by the charge that can be levied for the recovery. For the MACs owners the incentive is provided by the recovery charge being maintained at a favourable differential below the current price for new CFC-12 at the time of servicing.
d. It is expected that by the dictates of supply and demand the price of CFC-12 will substantially increase with time which should more than offset the falling servicing market for CFC-12 MACs due to progressive phaseout of unit.
e. The main cost to the service station are electricity, filters and labour.

6. For suitable control of this project one company should be appointed to control :

a. Distribution of the recycling equipment
b. The provision of adequate training and maintenance
c. To promote maximization of the utilization of the recycling equipment.

7. For this scheme to succeed it is necessary for one organization to excercise a strong control therefore Nippondenso who controll about 80% of the MACs sold in Indonesia has been selected as they :

a. Have already purchased and distributed 45 units of recycling equipment
b. They have the good relationship with their dealer network even though these are independent companies.
c. They have already arranged training courses
d. They are prepared to provide equipment to recover the CFC-12 from other MACs equipment. The other company manufacturing MACs in Indonesian is Sanden who did not raise objections to the scheme. There are also imported units on the market (fitted in preassembled imported cars)
e. Many service outlets services use both Nippondenso and Sanden equipment
f. Nippondenso management were very supportive with this project and did not consider that this was important to them as a profit centre but merely wished to cover their costs.
g. NIPPONDENSO has already gained considerable experience with this scheme.
h. There is no MACs manufacturers association at present in Indonesia.
i. In allocation of the recycling machines including withdrawal and reallocation if a particular service outlet proves unsatisfactory in its recovery performance.
j. In providing training to the operators in the use of the recycling equipment including routine minor maintenance, at the various locations.

8. It is proposed that the project start with a grant for 55 machines of which 50 are to distributed on a pilot basis to service shops in five urban areas in Java (Jakarta, Bandung, Semarang, Yogyakarta and Surabaya). If on the evaluation the scheme proves successful then the second phase of a grant for 330 machines should be implemented of which 320 are distributed

9. The recycling habit will have been established an it will also be necessary for the entrance to the market of MACs using 134a. HFC-134a has an undesirably high GWP.

10. The price of CFC-12 is expected to rise steeply as production decreases and the revenue to service stations should increase correspondingly.

11. There still will be a large number of cars using CFC-12 since the HFC-134a equipment will only reach the market in appreciable numbers at the end of 1995. Thus CFC-12 must be recycled to the maximum to supply these cars.

12. Finally it should be mentioned that importation of CFC-12 into Indonesia is to be banned after 1996 and none is produced here.

OZONE OPERATIONS RESOURCE GROUP

(OORG)

A TECHNICAL REVIEW

Republic of Indonesia

Reduction of CFC-12 Emissions During Service of Mobile Air Conditioners by Use of Recycling Equipment

Mobile Air Conditioning Sector

This review includes the information received October 11, 1994 in the form of a revised proposal.

RELATIONSHIP TO COUNTRY PROGRAMME:

This proposal appears to be compatible with the stated program which is to ban the import of CFC-12 after 1996.

This proposal relates directly to the objective of reducing the need to produce more CFC-12.

TECHNOLOGY:

The technology to perform refrigerant recovery and re-use is well established. The equipment description states that it is the type that performs on-sight recycling of the refrigerant. It is stated that transportation is the primary factor limiting the potential for central recycling of refrigerant. The on-sight recycling of refrigerant has the advantage of developing a technology that can be supported by favorable economics and can be carried forward to recovery of HFC-134a. There are also inventory advantages because re-use can be a short time element.

The project outline does not require action by any other element of the industry to impact the ODS emissions. It appears to be a stand alone program and anticipates that the conversion from CFC-12 to HFC-134a in new equipment will be addressed separately.

The potential for retro-fitting systems currently in use so that they can be serviced with HFC-134a is discussed. The inference is that the industry is not sophisticated enough or that the parts network is inadequate to effect the retrofit at an acceptable economic level.

The concept of recovery and re-use is important and can contribute significantly to the objective of reducing the emissions of CFC. The program should have training and incentives to encourage the service operation to reduce the leakage and repair incidents. The associated reduction in service requirements is a negative incentive for most service operations and should be recognized.

The technology of reclaiming and recycling is established but it does require skill and diligence. Personnel training is reported as the lowest cost item (annex 1), and at about one fifth of the cost of recruiting and delivery of the equipment, it seems disproportionately low.

ENVIRONMENTAL IMPACT:

The service training and the practice of recovering and reusing the refrigerant will not only reduce the CFC-12 (an ODS) emissions but, if carried forward it will apply to the reduction in HFC-134a (a greenhouse gas) emissions.

PROJECT COSTS:

The cost estimates for ODS saving is more favorable than in some other programs that have been proposed and, the probability of the program continuing after the initial funding does seem likely because the availability of virgin CFC-12 is to be limited. The alternate to using recovered refrigerant will be either a substitute refrigerant (all known substitutes have adverse effects), illegal import, or retrofit, all of which are more costly to the consumer.

The cost of the equipment is significant and is a new requirement for the service agency. The labor cost associated with operating the equipment is a new requirement for the service industry also. The ability of the service industry to absorb at least some of these costs will determine the amount of HFC-134a (a greenhouse gas) recovered and salvaged when the industry has converted to all HFC-134a systems. This has been accomplished in other areas by taxes on virgin refrigerant and other incentives.

The pilot program concept is recognized as a method of improving the effectiveness of the funding and assuring the accomplishment of the stated objective. The review of phase one is important and phase two should not be implemented until the review is completed and published.

IMPLEMENTATION TIMEFRAME:

I believe the proposed implementation time frame is feasible if training incentives are provided. One of the considerations of training and incentives is the indoctrination of the service personnel to produce leak free systems. This results in less frequent service requests and is therefore difficult to implement, unless the loss in income is replaced in some way.

The significance is that the program instigators may be prompt and the equipment may be in place but the real effective date is when the service personnel become effective

RECOMMENDATIONS:

This program is important because it can identify the requirements for, and our ability to, effect a very significant reduction in CFC emissions by recovery and re-use. It can serve as a guide for other proposals. The motivation of the individual service operation is an important factor and is relevant to the effectiveness of the program. I recommend that the program be funded as requested (in two parts) and be monitored closely for effectiveness and for guidance for other proposals.

I recommend that a simultaneous study be conducted to determine the method of supporting the recovery and re-use equipment and labor costs without the need for grants, to assist in the development of similar programs in other countries.

OORG TECHNICAL REVIEWER------------------ROBERT H. PROCTOR

DATE REVIEW COMPLETED------------------------12 October, 1994

The Montreal Protocol on Substances that Deplete the Ozone Layer Indonesia ODS Phase Out Project

Project Cover Sheet

COUNTRY:	Republic of Indonesia
PROJECT TITLE:	Elimination in Production of halon 1211 Fire Protection Extinguishers
SECTOR COVERED:	Fire Protection
ODS USE IN SECTOR:	Approximately 240 MT of halon 1211 in 1993
PROJECT IMPACT:	Phaseout of average 155 MT of halon 1211 in new fire extinguisher production (465 ODP-weighted MT) per year
PROJECT DURATION:	1 year
PROJECT ECONOMIC LIFE:	10 years
TOTAL PROJECT COST:	ODS Reduction Investment Costs: US$ 895,700 Incremental Operating Savings: US$ (141,800) Total Project Cost US$ 753,300
COST EFFECTIVENESS:	US$ 0.14/ODP-weighted kg of ODS phased out
PROPOSED OTF FINANCING:	US$ 892,300 as grant (incl. 15% for contingency and 3% for financial agent)
IMPLEMENTING ENTERPRISE:	1. CV. Dahlia Cahaya 2. PT. Bayu Sentosa Agung 3. PT. Chubb Lips Indonesia
COORDINATING MINISTRY:	State Ministry of the Environment (LH)
IMPLEMENTING AGENCY:	The World Bank

PROJECT SUMMARY

This project will phaseout an annual consumption of average 465 ODP-weighted MT of halon 1211 used for producing fire extinguishers at CV Dahlia Cahaya, PT Bayu Sentosa Agung, and PT Chubb Lips Indonesia. These three companies already produce ABC multipurpose dry powder and assemble carbon dioxide extinguishers. Funds are required for investment and conversion of equipment to cover increased production of non-halon extinguishers resulting from an early shutdown in the production of halon 1211 portable fire extinguishers. The requested project financing considers that CV Dahlia Cahaya, PT Bayu Sentosa Agung, and PT Chubb Lips Indonesia will offset its shutdown in production of halon 1211 fire extinguishers with an increase in production of dry powder and carbon dioxide extinguishers and that this change results in net incremental operating savings. The project has been packaged to include all three companies in the sector because there are some additional sector-level incremental cost that will be shared by all companies.

TECHNICAL ASSESSMENT : This project was reviewed by OORG reviewer Mr. Phil DiMenno. His recommendation for approval is attached.

PROJECT OBJECTIVE

The objective of this project is to phaseout the use of halon 1211 in all fire equipment manufacturing in Indonesia by eliminating halon 1211 extinguisher manufactures.

SECTOR BACKGROUND

Because halon extinguishers have unique properties, such as clean, non conducting, efficient, low toxicity, rapid knockdown of flame, halons have been extensively used in Indonesia in the 1980's. The main use of halon for fire protection in Indonesia are the oil industry, power plants, telecommunications, aviation, defence, as well as protection of computer installations, and special areas in high-rise buildings. The use of halon in 1992 is approximately 155 metric tonnes of halon 1211 and approximately 50 metric tonnes of halon 1301, which make the total of 205 metric tonnes of halon, or equivalent to a total application approximately 1,000 ODP tonnes. In 1993 there is a tendency to increase halon usage up to 240 metric tonnes of halon.

The project only addresses halon use for new production, for which an additional sector wide project (likely funded through UNDP) will address halon for refilling existing extinguishers, public awareness, and standard codes.

ENTERPRISE BACKGROUND

<u>Dahlia Cahaya</u>

Dahlia Cahaya is a fire extinguisher producing company situated in Jakarta. Dahlia produces several types of fire extinguishers under the trade - name of ALPINDO. This company has 100 % of Indonesian ownership without any branch in the other place. Dahlia was established and put into operation in 1970. It is designated to manufacture domestic-made extinguisher with higher local content. The name of ALPINDO is actually an abbreviation of Alat Pemadam Api Indonesia, meaning Indonesian Fire Extinguishers. Dahlia has 26 employees working in the factory building in Cikupa, West Java which cover the area of 2,000 M^2. Dahlia uses 57 tons of Halon 1211 and 15 tons of Halon 1301 a year, accounting for 30% of sector consumption per 1993 in Indonesia. Of this amount, approximately 60 - 75% is used for new product.

Halon type extinguisher is the main product of Dahlia, so the phase-out of halon will be substantially influence the business continuity of this company. Therefore, the project investment provided by MPMF related to the conversion of non-halon product has received a significant response from Dahlia. Currently, Dahlia only produces a small number of a limited range of ABC dry powder extinguishers. Due to halon phaseout, company plan to increase the number and type of production of dry powder as well as CO_2 type extinguishers.

Bayu Santosa Agung

Bayu Santosa Agung is the first and the largest company of fire extinguishers in East Java, which main production is halon extinguishers. Bayu has put the halon-1211 through the production from Wormald International (Australia) since 1970. This company was built and put into operation in 1974 in Sidoardjo, Surabaya, under the joint-share with Wormald Australia. However, since 1986, Bayu obtained 100% Indonesian ownership. The factory has 35 employees, including 3 engineers, and 15 employees in 5 (five) branches, making the total employees of 50 personnels.

Bayu is the major company for fire extinguishers and sells its products mostly for the eastern part of Indonesia. The factory building is approximately 2,000 M^2, with the annual consumption of halon 1211 around 60 metric tonnes accounting for about 25% of sector consumption per 1993 in Indonesia. From this amount, ten percent was used for refilling or 55 metric tonnes used for new production.

Since halon type extinguisher is the main product of Bayu, the phase-out of halon will be substantially influence the business continuity of this company. Therefore, the project investment provided by MPMF related to the conversion of non-halon product has received a significant response from Bayu. Currently, Bayu only produces a small number of a limited range of ABC dry powder extinguishers and no production of CO_2 extinguishers. Due to halon phaseout, company plan to increase the number and type of production of dry powder as well as CO_2 and foam type extinguishers. New type of dry powder extinguisher proposed by Bayu in catridge system.

Chubb Lips Indonesia

Chubb Lips Indonesia was established and put into operation in 1973. Chubb is a joint venture and at this stage the composition of shares are 51% local and 49% Chubb Security, PLC, United Kingdom. The company was concentrating on the production of safes, locks and starting 1987 a new factory was built in Citeureup, West Java to produce protable extinguishers and trolley units. Due to government regulations for joint-venture company, the distribution of the extinguishers has to be done through another local company, PT. Indolok Bakti Utama as sole distributor. Chubb has 60 employees in the plant, with its distribution branches located in 27 provinces in Indonesia, making the total employees of more than 350 personnel.

The factory area is approximately 7,000 M^2 with normal capacity 24,000 extinguishers units per year ranging for halon extinguishers, dry powder, foam and water. halon extinguisher production is more than 15,000 units per year up to 1991, where reduction of halon extinguisher capacity has started in 1993. Chubb used 100 metric tonnes of halon 1211 or approximately 42 % of sector consumption in Indonesia in 1993. Of this amount 35% is used for refilling. With the phaseout of the halon 1211 and due to the difference in prices between halon and other products (dry powder, CO_2, water, foam, etc) if the company want to achieve a 15% volume increase yearly, Chubb needs to produce at least double the quantity (± 50,000 units) in the next 3 to 4 years.

The company realized the importance of halon phaseout, therefore starting from 1991 the production has already been substantially reduced. In addition to that, Chubb also encourage used of other four types of extinguishers such as ABC Dry Powder, CO_2, and Foam. These products also increase starting from 1991.

PROJECT DESCRIPTION

The project will involve providing the enterprises with funding to cover its incremental investment costs resulting from an early shutdown of halon 1211 fire extinguisher production.

Currently, all the three companies already produce both ABC multipurpose dry powder (ammonium phosphate) and fill carbon dioxide fire extinguishers and lost production of halon 1211 is met by increased production of these two types of non-halon extinguishers. Once halon 1211 is stopped, it will be 50% shift to ABC DP and 50% shift to CO_2.

Funding is required for purchasing an additional equipment which needed to produce multipurpose dry powder and and carbon dioxide extinguishers currently produced.

JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY

There will not be any new alternative technologies introduced at PT. Bayu. The loss in production of halon 1211 extingushers will be met by increased production of ABC multipurpose dry powder and carbon dioxide fire extinguishers.

Like halon 1211, ABC multipurpose (ammonium phosphate) dry powder can extinguish Class A, B, and C fires. One disadvantage of ABC multipurpose dry powder is that it can leave a rusty residue that must be removed to avoid corrosion. In addition, more ABC dry powder required to extinguish fire in comparison of halon 1211.

Key properties of carbon dioxide include its inert and clean characteristics. Also, it is non-conducting and is therefore suitable for Class C (electrical) fires. Disadvantages of carbon dioxide include its inability to extinguish Class A fires and its inferior performance vis-a-vis halon 1211 in windy conditions. Because of its higher vapor pressure, it requires heavier extinguisher bottles. In addition, similar as dry powder, more carbon dioxide is required to extinguish fires in comparison to halon 1211, and because of its higher vapour pressure, it requires extinguishers bottles.

PROJECT COSTS

Investment Costs of US$ 895,100 are needed to purchase and modify some equipments, installation, upgrading stock room, and also for training. Training is needed for production and service operator whose not familiar yet with non halon production, and sales promotor to change the public opinion of usage from halon to non halon extinguishers. Other sector level investment costs such a costs such as costs for a public awareness program and for changing fire codes and standards will be covered through UNDP project on halon banking. Investment cost are detailed in Annex A.

Operating Savings of US$ (141,800) are calculated based on current unit production cost of halon 1211, ABC Dry Powder, and carbon dioxide extinguishers. It is assumed that the lost of production of halon 1211 extinguishers will be offset by increased production of dry powder and carbon dioxide extinguishers.

Other Costs. A 15% contingency of US$ 113,100 was also included to ensure adequate funding of project costs following project appraisal. An additional US$ 26,000 (3%) was added to the grant request to cover the fee for services of the financial institution (FI) that will appraise the projects and oversee procurement, disbursement and supervision.

Requested Funding. The proposed OTF grant for the three enterprises was calculated as follows: the present value of the net incremental costs was increased by a 15 percent contingency to yield the grant amount. Finally, this figure was increased by 3 percent to account for the financial institution fee. For Chubb, the fund requested has been reduced by its 49% foreign ownership.

UNIT ABATEMENT COST (UAC)

As derived in Annex C the UAC calculated over the ten years of economic life of the project is US$ 0.14 per ODP-weighted kg of halon 1211 phased out. This number is derived from the incremental annualized investment costs of US$ 145,800 and average annual savings of approximately 465 ODP-weighted MT of halon 1211 assuming a 10 percent annual growth rate in demand for halon 1211. Because the UAC is so low, the project is extremely cost effective and an excellent candidate for funding.

REQUIRED REGULATORY ACTIONS

It is recommended that once grant financing has been provided for this project, the State Ministry of Environment ensures that production of halon 1211 fire extinguishers remains shutdown at Dahlia, Bayu, and Chubb.

RESULTS

This project will eliminate the annual use of at least 465 ODP-weighted MT of halon 1211.

Other Costs. A 15% contingency of US$ 113,100 was also included to ensure adequate funding of project costs following project appraisal. An additional US$ 26,000 (3%) was added to the grant request to cover the fee for services of the financial institution (FI) that will appraise the projects and oversee procurement, disbursement and supervision.

Requested Funding. The proposed OTF grant of US$ 892,300 for the three enterprises was calculated as follows: the present value of the net incremental costs was increased by a 15 percent contingency to yield the grant amount. Finally, this figure was increased by 3 percent to account for the financial institution fee. For Chubb, the fund requested has been reduced by its 49% foreign ownership.

UNIT ABATEMENT COST (UAC)

As derived in Annex C the UAC calculated over the ten years of economic life of the project is US$ 0.14 per ODP-weighted kg of halon 1211 phased out. This number is derived from the incremental annualized investment costs of US$ 145,800 and average annual savings of approximately 465 ODP-weighted MT of halon 1211 assuming a 10 percent annual growth rate in demand for halon 1211. Because the UAC is so low, the project is extremely cost effective and an excellent candidate for funding.

REQUIRED REGULATORY ACTIONS

It is recommended that once grant financing has been provided for this project, the State Ministry of Environment ensures that production of halon 1211 fire extinguishers remains shutdown at Dahlia, Bayu, and Chubb.

RESULTS

This project will eliminate the annual use of at least 465 ODP-weighted MT of halon 1211.

ANNEX A

INVESTMENT COST

No.		Quantity (unit) Chubb	Dahlia	Bayu	Price (US$/unit)	Total Incremental Cost (US$)	Brand (Supplier)
	I. EQUIPMENT						
1.	Filling Machine for ABC Powder #)	1	1	1	27,300	81,900	Vulkan, Germany
2.	Filling Machine for CO2 #)	1	1	1	63,700	191,100	Stahotec, Germany
3.	Hydrostatic Tester for all cylinders #)	1	1	1	7,000	51,000	Venzetti, Italy
4.	Compressor for ABC DP #)		1	1	7,840	15,680	
5.	Roll Machine #)		1	1	12,400	24,800	JORG HD
6.	Pressing Machine #)		1	1	25,500	51,000	AGP 200
7.	Guillotine' Cutting Machine #)		1	1	28,150	56,300	Colmal
8.	Powder Coating Machine #)		1	1	20,000	40,000	
9.	Paint-bake Oven #)		1	1	5,000	10,000	
10.	Work centre complete with equipments of filling and pressuring of ABC DP, CO2, and Foam #)	1	1	1	17,000	51,000	Electro Pnematic
11.	Digit Scale-D for lowering the cylinders through the floor and locking clamp #)	1	1	1	25,000	75,000	Electro Pnematic
12.	Clamp Automatic for all cylinders #)	1	1	1	12,000	36,000	Electro Pnematic
13.	Matic Screwer for CO2 Cylinders #)	1	1	1	18,000	54,000	Electro Pnematic
14.	Cylinder drying unit for drying the cylinders from moisture before filling the dry powder #)	1	1	1	7,000	21,000	Vanzetti, Italy
15.	Cylinder cleaning unit for cleaning the cylinders from outside #)	1	1	1	13,000	39,000	Vanzetti, Italy
	II. IMPROVEMENT THE OLD MACHINES						
16.	Welding Machine (MIG) *)		1	1	30,000	60,000	Multi Machine Tool
17.	Welding Machine (TIG) *)		1	1	30,000	60,000	Multi Machine Tool
					348,890		
	III. INSTALLATION NEW EQUIPMENT	10,000	10,000	10,000		30,000	
	IV. UPGRADING STOCK ROOM	10,000	10,000	10,000		30,000	
	V. TRAINING (production & service operator, sales promotor)	20,000	20,000	20,000		60,000	
	TOTAL	230,000	388,890	388,890		1,037,780	
	Reduced by % of foreign ownership	117,300	388,890	388,890		895,080	

#) These machines are needed to increase the production and range of ABC DP and fill of CO2 extinguisher

*) These machines are already exist, but due its expansion of ABC DP type extinguisher, it needs modification of the old machines. Incremental investment cost is addressed to modify these old machines.

TOTAL INVESTMENT COST IS US$ 895,080

Annex B
Incremental Cost

DAHLIA CAHAYA

GROWTH RATE 1.1

HALON 1211 USE *)	1993	1994	1995	1996	1997	1998
(METRIC TONNES)	14	15.4	16.94	18.634	20.497	22.547

ODP OF H-1211 3

*) These figure represent the amount for new production

TABLE B.2 INCREMENTAL CHANGE IN UNITS, USING 1993 AS A BASELIN

ITEM	1993	1994	1995	1996	1997	1998
BASELINE H-1211	6207	6828	7510	8262	9088	9996
BASELINE ABC DP	11012	12113	13325	14657	16123	17735
BASELINE C02	1510	1661	1827	2010	2211	2432
POST MP H-1211	6207	6828	0	0	0	0
POST MP ABC DP	11012	12113	17080	18788	20667	22733
POST MPC02	1510	1661	5582	6141	6755	7430
INCREMENTAL H-121	0	0	-7510	-8262	-9088	-9996
INCREMENTAL ABC D	0	0	3755	4131	4544	4998
INCREMENTAL C02	0	0	3755	4131	4544	4998

ASSUMPTIONS:

ONCE HALON 1211 IS STOPPED

% SHIFT TO ABC DP 0.5

% SHIFT TO C02 0.5

TABLE B.3 AVERAGE COST PRODUCTION BY EXTINGUISHER

ITEM	Rp	US$
HALON 1211	143775	71.89
ABC DP	93599	46.80
C02	186680	93.34

TABLE B.4 INCREMENTAL OPERATING COST (US$)

INCREMENTAL OPER	1993	1994	1995	1996	1997	1998
COST FOR 4 YEARS	0	0	-13652	-15017	-16519	-18171

NPV OF OPERATING COSTS (SAVING US$ -49,644

dahlia\annex-b

10/13

Annex B
Incremental Cost

CHUBB LIPS

GROWTH RATE	1.1					
HALON 1211 USE *)	1993	1994	1995	1996	1997	1998
(METRIC TONNES)	65	71.5	78.65	86.515	95.1665	104.68315
ODP OF H-1211	3					

*) These figures represent the amount of Halon used for new production

TABLE B.1 INCREMENTAL CHANGE IN UNITS

ITEM	1993	1994	1995	1996	1997	1998
BASELINE:						
H-1211	7295	8025	8827	9710	10681	11749
ABC DP	25344	27878	30666	33733	37106	40817
C02	1632	1795	1975	2172	2389	2628
PROJECT						
H-1211	7295	8025	0	0	0	0
ABC DP	25344	27878	35080	38588	42446	46691
C02	1632	1795	6388	7027	7730	8503
INCREMENTAL						
H-1211	0	0	-8827	-9710	-10681	-11749
ABC DP	0	-0	4413	4855	5340	5874
C02	0	0	4413	4855	5340	5874

ASSUMPTIONS:
-ONCE HALON 1211 IS STOPPED

% SHIFT TO ABC DP	0.5
% SHIFT TO C02	0.5

TABLE B.2 AVERAGE PRODUCTION COST BY EXTINGUISHER

ITEM	Rp	US$
HALON 1211	163758	81.88
ABC DP	78536	39.27
C02	246382	123.19

TABLE B.3 INCREMENTAL OPERATING COST (US$)

INCREMENTAL OPERAT	1993	1994	1995	1996	1997	1998
COST FOR 4 YEARS	0	0	-5733	-6306	-6937	-7631

NPV OF OPERATING COSTS (SAVING)	US$	-20848
REDUCED BY % OF FOREIGN OWNERSHIP	US$	-10632.

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Annex B
Incremental Cost

BAYU SANTOSA AGUNG

GROWTH RATE 1.1

HALON 1211 USE *)	1993	1994	1995	1996	1997	1998
(METRIC TONNES)	55	60.5	66.55	73.205	80.5255	88.57805

ODP OF H-1211 3

*) These figures represent the amount of Halon used for new production

TABLE B.1 INCREMENTAL CHANGE IN UNITS

ITEM	1993	1994	1995	1996	1997	1998
BASELINE:						
H-1211	15025	16528	18180	19998	21998	24198
ABC DP	3555	3911	4302	4732	5205	5725
C02	0	0	0	0	0	0
PROJECT						
H-1211	15025	16528	0	0	0	0
ABC DP	3555	3911	13392	14731	16204	17824
C02	0	0	9090	9999	10999	12099
INCREMENTAL						
H-1211	0	0	-18180	-19998	-21998	-24198
ABC DP	0	0	9090	9999	10999	12099
C02	0	0	9090	9999	10999	12099

ASSUMPTIONS:
-ONCE HALON 1211 IS STOPPED
% SHIFT TO ABC DP 0.5
% SHIFT TO C02 0.5

TABLE B.2 AVERAGE PRODUCTION COST BY EXTINGUISHER

ITEM	Rp	US$
HALON 1211	143768	71.88
ABC DP	86068	43.03
C02	196531	98.27

TABLE B.3 INCREMENTAL OPERATING COST (US$)

INCREMENTAL OPERAT	1993	1994	1995	1996	1997	1998
COST FOR 4 YEARS	0	0	-22421	-24663	-27129	-29842

NPV OF OPERATING COSTS (SAVINGS): US$ -81530

TOTAL NPV OF OPERATING COSTS (SAVINGS) FOR THIS SECTOR IS US$ (141,800)

bayu\annex-b

Annex C

Unit Abatement Cost

C.1	ODS Saving			
	ODP of Halon 1211		3.0	
	Annual growth in Halon 1211 baseline demand		10	percent
	Average Annual ODS Phased-out		155	MT
	Average Annual ODP Phased-out		465	MT
C.2	Incremental Capital Cost			
	Economic Life of Project		10	years
	Total Investment Cost	US$	895,100	
	Annualized Incremental Capital Cost	US$	145,673	
C.3	Annualized Incremental Operating Cost (savings)	US$	81,704	
C.4	Unit Abatement Cost (US$/kg ODP phased-out)		0.14	

Review of Halon Phaseout Project

Republic of Indonesia

October 26, 1994

Project Title: Elimination in Production of Halon 1211 Fire Extinguishers

ODS Use: 240 MT of Halon 1211

Impact: Phaseout of Halon 1211 in new fire extinguisher production

Project Cost:	ODS Reduction Investment Cost	~US $895,100
	Incremental Operating Cost	(141,300)
	Total Project Cost	~US $753,300

1. **Recommendation**

The project is recommended for approval.

2. **Relevant and Adequacy of Information**

The information presented is adequate to perform this evaluation, assuming cost estimates for equipment are verified.

3. **Technical Soundness**

The technologies proposed are proven, cost effective, and low risk. The utilization of both DCP and CO_2 is well considered.

4. **Lessons from Experience**

Other similar projects have been proposed. This is one of the most cost effective. It also provides much broader coverage across the use areas.

5. **Environmental Issues**

None.

6. **Safety Issues**

None beyond standard light industrial health and safety concerns.

7. **Cost Effectiveness**

Cost effectiveness is acceptable. Could be made more so by consolidating production in one enterprise, but this is probably not reasonable.

COUNTRY	:	Republic of Indonesia
PROJECT TITLE	:	Elimination of Ozone Depleting Substances Used in the Production of Household Refrigerators at P.T. Lippo Melco Manufacturing.
SECTOR COVERED	:	Refrigeration.
ODS USE IN SECTOR	:	77.9 MT of CFC-12 (73.1 MT in new appliances), and 306 MT of CFC-11 in 1993. Total of 383.9 MT (383.9 ODP - weighted MT).
PROJECT IMPACT	:	Eliminate annual consumption of 13.19 MT of CFC-12. Total of 13.19 ODP - weighted MT after the conversion is completed.
PROJECT DURATION	:	Phase I : 3.5 years Phase II : 2.5 years Phase III : 4.0 years
PROJECT ECONOMIC LIFE	:	10 years
TOTAL PROJECT COST	:	ODS Reduction Investment Cost : US$ 0.899 million Incremental Operating Cost : US$ 0.283 million Incremental Operating Revenue : US$ 0 Total ODS Reduction Project Cost : US$ 1.182 million Other Project Costs : US$ 0 Total Project Costs : US$ 1.182 million
COST-EFFECTIVENESS	:	US$ 32.53 / ODP-weighted kg.
PROPOSE OTF FINANCING	:	US$ 738,000 as grant (including 15 % contingency and 3 % financial fee).
IMPLEMENTING ENTERPRISE	:	P.T. Lippo Melco Manufacturing.
COORDINATING MINISTRY	:	Indonesia State Ministry of Environment.
IMPLEMENTING AGENCY	:	The World Bank.

PROJECT SUMMARY

This project will terminate the use of CFC-12 used in household refrigerators manufactured at P.T. Lippo Melco Manufacturing (LMM) in Indonesia. The project comprises of three phases and will convert the production line to handle refrigerators using HFC-134a as the new refrigerant. Phase I will provide for product development using non-ODSs and will identify all equipment and process changes needed to implement the alternative technology. During this phase, LMM will seek engineering assistance and training from her parent company, Mitsubishi Electric Corporation of Japan.

In phase II LMM will purchase and install equipment necessary for mass production of non-ODSs refrigerators. Main investment in this phase is for controlled ambient testing room and auto-tester for testing line. The implementation of HFC-134a will be conducted in phase III.

This project will result in the elimination of 13.19 MT/year of CFC-12 (refrigerant) after the conversion is completed.

TECHNICAL ASSESMENT

This project proposal is being submitted to the OORG reviewers for final approval. The revised proposal has addressed the concerns raised by the foam and refrigeration reviewers in their preliminary reviews.

PROJECT OBJECTIVE

The objective of this project is to retire an existing CFC-using refrigerator plant and put into operation a replacement plant that uses non-CFCs at P.T. Lippo Melco Manufacturing. The project provides for the purchase of equipment, the transfer of technology, and the training necessary to facilitate an effective transition to HFC-134a for the refrigerant.

SECTOR BACKGROUND

In 1993, the domestic refrigeration industry in Indonesia consumed approximately 383.9 MT of Chloro-Fluoro-Carbons (CFC) representing 3.7 percent of the country's consumption of CFC. Of the sector's total use of CFC, household appliances accounted for 77.9 MT of CFC-12, with approximately 73.1 MT used to charge new appliances during manufacture and 4.8 MT used for servicing by appliance repair shops. In addition, about 306 MT of CFC-11 were used in the production of polyurethane (PU) appliance insulation foam.

The production of household refrigerators and freezers in Indonesia has increased significantly in the past four years, from about 335,000 units in 1991 to approximately 520,100 units in 1993, from which 70,000 units were exported to Middle East, South America, and other countries. Most refrigerators sold in Indonesia made locally by eight major manufacturers : National Gobel, Sharp Yasonta Indonesia, Sanyo Industries Indonesia, Topjaya Antariksa Electronics, Lippo Melco Manufacturing, Samsung Maspion Indonesia, Goldstar Astra and Harapan Daya Utama.

Household refrigerators produced are relatively small, typically around 150 to 165 liters. The average charge of CFC-12 in refrigerators manufactured in Indonesia is around 0.140 kg. In addition an average of 0.580 kg of CFC-11 is used in making the rigid polyurethane foam in the cabinet. Since 1993 almost all refrigerator manufacturers in Indonesia have started using 20 percent CFC-11 reduced polyurethane foam formulations.

Up to now compressors demand is fulfilled by importing from other Asian countries such as Singapore (Matsushita) and South Korea (Goldstar and Samsung). This year (1994) Sanyo Compressor Indonesia has started production of reciprocating type compressors for export and later for the local market. This manufacturer is going to produce both R-12 and HFC-134a compressors up to 1997 which is the phase out of CFC set by the Indonesian government.

ENTERPRISE BACKGROUND

PT Lippo Melco Manufacturing (LMM) is located north east of Jakarta in Pulogadung Industrial Estate. 52.73 % of the company is Indonesia owned while the rest is owned by Mitsubishi Electric Corporation of Japan. LMM employs 299 people in her refrigerator production line and her 1993 revenue was approximately US$ 17.91 million.

LMM produced her first refrigerator in 1984 and obtaind her producing license from her parent company, Mitsubishi Electric Corporation of Japan. In 1993 total production reached 40,500 units of refrigerators, they were domestically marketed and held 12% of the market. Within the next 10 years period LMM has no intention in marketing her products overseases. With one production line and a total installed capacity of 76,500 units per year, LMM is producing five models of refrigerators, specifically 80 litres, 130 litres, 150 litres (1 door model), 170 litres, and 198 litres (2 doors model). LMM is looking forward to reach her present maximum capacity in 1996.

Since August 1993 LMM has used 30% reduced CFC-11 polyurethane foam formulation as a transition step towards non-ODSs technology implementation. During transition period 18.49 MT of CFC-11 can be reduced and after the elimination of ODSs it is expected that 9.16 MT of CFC-12 and 38.52 MT of CFC-11 can be saved annually. These figures are based on typical charge size of CFC-12 (0.102 kg per unit), allowing 5% for calibration/rework and an average of 0.495 kg of CFC-11 for foam blowing agent.

Based on installed capacity of 76,500 units per year, LMM has 1 production line which is consist of :

1. Steel cabinet and door forming line
2. Painting line
3. Thermoforming line
4. Preassembly line for cabinets and doors
5. Polyurethane foaming line
6. Assembling line
7. Evacuating and charging line
8. Testing line
9. Repairing line
10. Packing line

In evacuating, charging and testing line LMM utilizes 20 units vacuuming pumps from Shimadzu, 1 charging machine from Toto Denki, 3 halogen leak detectors from Suzuki Giken, 1 insulation resistance tester from Yokogawa and 1 dielectric tester from Yamabishi.

For controlling production quality LMM uses 10 units temperature recorders from Chino and Yokogawa, 8 units have been purchased and been using for monitoring HFC-134a first stage prototypes.

PROJECT DESCRIPTION

In this project, P.T. Lippo Melco Manufacturing will eliminate the use of ODSs in refrigeration circuit of household refrigerators by converting its manufacturing facility to one that is capable of handling HFC-134a. The elimination of ODSs in rigid insulation foam will be submitted in another proposal, after LMM received necessary data from Mitsubishi Electric Corporation of Japan, which is expected around the end of 1994.

The project is divided into three phases ; Phase I will provide for engineering assistance, training and acquisition of specific testing equipment for non-ODSs refrigerators. Phase II will allow for the preparation towards non-ODSs technology through the procurement and installation of equipment necessary for mass production of non-ODSs refrigerators. Phase III, which is the final phase of non-ODSs technological implementation, will involve actual production of non-ODSs refrigerators.

The main objective of phase I consists of developing reliable non-ODSs refrigerators for LMM. This task is particularly difficult to accomplish given the considerable engineering design modifications and the necessary testing that have to be done in a relatively short period. In order to minimize the risks associated with the conversion process, LMM will request technical assistance from her parent company, Mitsubishi Electric Corporation of Japan, during this phase. This technical assistance represents a continuation of existing arrangements between the two companies. P.T. Lippo Melco Manufacturing has been using similar arrangements to develop her present refrigerator models since 1984.

The emphasis in phase I is to provide Indonesia partner with the technology developed by the parent company in Japan, modifying it whenever necessary to account for differences in Indonesia manufacturing conditions and produced models. As part of the technical agreement, Mitsubishi Electric Corporation of Japan will do the following :

1. Redesign of refrigeration circuit for present LMM models.
2. Conduct approval test for HFC-134a compressors (from Matsushita Singapore).
3. Conduct approval test for non-ODSs (HFC-134a & cyclopentane) LMM refrigerators.
4. Provide training in manufacturing, quality control and maintenance of non ODSs equipment.
5. Provide production drawing for non-ODSs LMM refrigerators.

LMM requests additional fund for phase I to procure the following machinery and equipment:

1. A controlled ambient testing room with data acquisition system as the HFC-134a and cyclopentane prototypes should be tested under specific ambient. Based on phase-out scenario this equipment will be used for testing HFC-134a prototypes and then cyclopentane ones.

2. 8 units of hybrid temperature recorder (12 channels) for monitoring performance of prototypes.

3. A dryer moisture analyzer to confirm that moisture content in new supplied dryer is within design specification.

4. A parts moisture analyzer, to confirm the quality consistency of new supplied refrigeration circuit components, except dryer, in terms of their moisture content.

5. A refrigerant and non-condensible gas analyzer, to measure actual charged refrigerant into refrigerator. Also to determine the amount of non-condensible gas in refrigeration circuit.

All above equipment are not available in LMM and will be used for testing the prototypes and its components in phase I and in Phase III to ensure that they are manufactured according to design specifications.

Phase II will consist of finalizing the transition from CFCs technology to non-ODSs in mass production. During this period LMM will install :

1. A charging machine which is capable of handling HFC-134a. Present facility still be used to handle CFC-12 during transition period and cannot be retrofitted to handle HFC-134a because already contaminated by chlorine.

2. An air conditioned assembling line to keep ambient humidity on 70%. HFC-134a compressor will be supplied with ester oil in it while present humidity inside factory is 85%.

3. 2 units slat conveyor for evacuating line, to minimize handling time between evacuating station and charging station as vacuum level of refrigeration system should be less than 0.3 mm Hg. Average manual handling time on present free roller conveyor between these two stations is 1.5 seconds and it will cause vacuum level to be 0.6 mm Hg.

4. 3 units R-134a leak detectors because existing ones reacts only on halogen gas.

5. 2 units slat conveyor equipped with auto-tester equipment for testing line. HFC-134a refrigerators will be tested for 1 hour instead of 45 minutes. Installed production capacity should be kept in same available testing space (total 24 m in length) therefore manual handling on free roller conveyor, by 2 operators at present, should be avoided.

Phase III will complete the implementation of non-ODSs technology in refrigerator production.

JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY

Internationally, HFC-134a has been accepted as an alternative refrigerant to replace CFC-12 in household refrigerators. Hydrocarbons can also be used as refrigerants, but they are flammable and hydrocarbon compressors are not yet commercially available. HFC 134-a has no ODP, low GWP, good thermodynamic properties, and non-falammable substance. Several compressor and household appliance manufacturers have publicized their plan to convert from CFC-12 to HFC-134a. LMM is currently relying on Matsushita Singapore for compressors and in 1993, Matsushita supplied HFC-134a compressors (oil charged type) to LMM for testing purposes.

PROJECT COSTS

Total Project Cost

As described below and detailed in the relevant annexes, the total project cost for refrigeration system is US$ 1,181,988. This project is aimed entirely at ODSs elimination, as a result the total project cost is equal to the ODS reduction project cost. This project will not provide P.T. Lippo Melco Manufacturing with any incremental operating revenue.

Investment Costs

As detailed in Annex A, the net incremental capital costs for refrigeration system US$ 899,200. Major components of the costs include costs associated with equipment procurement, non-ODSs refrigerators product development, technical assistance from Mitsubishi Electric Corporation of Japan, prototype testing and training.

Operating Costs

In calculating the operating cost, it is taken into account that LMM produces 47,100 refrigerators in 1994. The operating cost is computed based on the production during 6 months in the 1994, regardless plan of LMM expansion. This is consistent with the Executive Committee's guidelines which state that the Multilateral Fund should not recover costs associated with plant expansion.

Incremental operating cost results from the increased cost of raw materials such as compressors, dryers, contaminant filters, condensor pipes, refrigerant.

Given a discount rate of ten percent (10%), the net present value of incremental operating costs minus the offsetting savings for the ten year project life is equal to US$ 282,788. A more detailed breakdown of operating costs is provided in Annex B.

Unit Abatement Cost (UAC)

As derived in Annex C, the unit abatement cost, for CFC-12 is US$ 32.53 per ODS-weight in kg. This amount is the summation of the annual incremental capital cost of US$ 0.146 million and annual net incremental operating cost of US$ 0.283 million then the total incremental cost is divided by the total annual savings in the first year conversion conducted of 13.19 MT ODPs.

Proposed OTF Financing

A grant with the amount of US$ 738,254 is requested from the OTF, and was calculated as follows : the net incremental capital cost was added to the net present value of the incremental operating cost over the six months production in the 1994. Then the total incremental cost was multiplied by the percentage of Indonesia ownership (52.73%), the result was then added to 15% (contigency) of itself and finally the amount is added to 3% (financial fee) of itself to yield the ultimate grant amount.

The 15 percent contigency is required to ensure that the implementing enterprise still receives adequate compensation in cases which the actual cost of items listed in this proposal exceeds their estimated cost.

Schedule

TASK	1993	1994	1995	1996	1997	1998	1999
Phase I:							
Model Development							
a. HFC-134a	xx	xxxx	xx				
b. Cyclopentane			xx	xxxx	xxxx		
Testing and Training	x	xxxx	xxxx	xxxx			
Phase II:							
HFC-134a Equipment Procurement & Installation		xx	xxxx				
Cyclopentane Equipment Procurement & Installation				xxxx			
Phase III:							
Full Production of non-ODSs Refrigerators				xxxx	xxxx	xxxx	xxxx

Note: x = one quarter of a year.

REQUIRED REGULATORY ACTIONS

No new regulations are required to implement this project. Under the existing agreement with the World Bank, equipment and machinery imported as a part of this project will be exempted from import duties levied by the Indonesian Government.

RESULTS

Direct Project Impacts

This project will phase out annually 13.19 MT of CFC-12 from Lippo Melco Manufacturing process post commencement of full-scale production of non-ODSs refrigerators in 1997. In total approximately 13.19 ODP-weighted in MT of ODS can be eliminated annually.

Indirect Project Impacts

This project will not influent the quality or reliability of the product but it will most likely elevate the product price. The environment impacts due to this project are to be negligible.

ANNEX A

CAPITAL COSTS

(estimated costs in US dollar)

Phase I

A Investment Costs for Model Development						US$	466,500	
1. Controlled ambient test room (with data acquisition system)				US$	140,900			
2. Hybrid temperature recorder		(8 units)		US$	14,500			
3. Dryer moisture analyzer				US$	56,100			
4. Parts moisture analyzer				US$	40,800			
5. Refrigerant non condensible gas analyzer				US$	10,200			
6. Technical assistance from Mitsubishi Electric Corporation of Japan				US$	204,000			
One-door model (3)		US$	68,000					
Two-door model (2)		US$	136,000					
B. Costs Associated with Testing of Refrigerators						US$	69,300	
Number of models	5							
Number of samples per model	14							
(1 for gas adjustment, 3 for contaminant effect, 3 for in-house life test, 3 for HFC-134a field test, 4 for cyclopentane field test)								
Average cost per sample				US$	990			
C Costs Associated with Training						US$	89,700	
1. Dispatch LMM Engineer to Japan (2 persons)				US$	58,500			
Number of days	270							
Cost per day	US$	150						
Training Expenses		US$	54,000					
Air Ticket		US$	4,500					
2. Dispatch Mitsubishi Engineer to Indonesia (8 persons)				US$	31,200			
Number of days	100							
Cost per day	US$	200						
Staying Expenses		US$	20,000					
Air Ticket		US$	11,200					
Total Investment Costs in Phase I							US$	625,500

Phase II

D	Investment Costs for Mass Production (Refrigerant Circuit)			US$	273,700		
1.	Refrigerant Charging Machine	(1 unit)	US$	65,300			
2.	Controlled Ambient Assembling Line	(1 unit)	US$	18,000			
3.	HFC-134a Leak Detector	(3 sets)	US$	12,200			
4.	Vacuuming Pumps	(20 sets)	US$	0			
5.	Driven Evacuating Line	(1 unit)	US$	24,500			
6.	Driven Testing Line	(1 unit)	US$	24,500			
7.	Auto Tester for Testing Line	(1 unit)	US$	122,100			
8.	Quick Joint Vacuum Coupler	(70 sets)	US$	7,100			
9.	Sample Testing Room	(1 unit)	US$	0			
10.	Lubricant Reclaimer	(1 set)	US$	0			
	Total Investment Costs in Phase II					US$	273,700
	Total Investment Costs					*US$*	*899,200*

Note :

- *The above estimation is based on the exchange rate of US$1.00 = Rp. 2,178 and US$ 1.00 = Y 97.98.*
- *Selection of above equipment are based on recommendation from Mitsubishi Electric Corporation of Japan (as a part of Technical Agreement between the two parties).*

ANNEX B

INCREMENTAL OPERATING COSTS

(estimated costs in US dollar)

1. Present Production Output

1.1. One Door Model	80 liter :	7,500 units
	130 liter :	14,300 units
	150 liter :	8,700 units
1.2. Two Door Model	170 liter :	8,100 units
	198 liter :	8,500 units

2. Incremental Operating Cost per Unit on Refrigerant Circuit

Model	Cost per Unit										Incr. Cost
	Compressor		Refrigerant		Dryer		Filter		Piping		
	Now	New	Now	New	Now	New	Now	New	Now	New	
80 ltr	30.95	36.21	0.12	0.62	0.59	1.07	0.00	3.88	1.19	2.18	11.11
130 ltr	30.95	36.21	0.22	1.14	0.59	1.07	0.00	3.88	1.40	2.41	11.55
150 ltr	31.80	37.21	0.20	1.03	0.59	1.07	0.00	3.88	1.73	2.76	11.63
170 ltr	36.57	42.79	0.30	1.55	0.59	1.07	0.00	3.88	3.11	4.23	12.95
198 ltr	36.57	42.79	0.32	1.65	0.59	1.07	0.00	3.88	3.55	4.70	13.06

Filter to be used in front of dryer to eliminate effect of contaminant and to be supplied as a part of compressor kit from Matsushita Singapore.

3. Net Present Value of Incremental Operating Cost

Model	1994 Prod.	6 months Prod.	Inc. Cost per Unit	Inc. Cost
80 ltr	7,500	3,750	11.11	41,663
130 ltr	14,300	7,150	11.55	82,583
150 ltr	8,700	4,350	11.63	50,591
170 ltr	8,100	4,050	12.95	52,448
198 ltr	8,500	4,250	13.06	55,505
Incremental Cost				282,788

NPV Incremental Operating Cost : 282,788

ANNEX C

UNIT ABATEMENT COST and PROPOSED OTF FINANCING

(estimated costs in US dollars)

1. ODS Saving

Average annual CFC-12 saved was based on ODS consumption in the first year conversion (1996), i.e. : 13,190 kg

2. Net Incremental Capital Costs

Overall project life, year	10	
Discount rate/year	10%	
Total incremental capital costs		899,200
Annualized incremental capital costs		146,341

3. Net Incremental Operating Costs

Overall project life, year	10	
Discount rate/year	10%	
Total incremental operating costs requested		282,788
Annualized incremental operating costs		282,788

4. Unit abatement cost

	Cost/year	Unit cost/kg ODP saved
Annualized incremental capital costs	146,341	11.09
Annualized incremental operating costs	282,788	21.44
Total unit abatement cost		32.53

5. Proposed OTF Financing

Net incremental capital costs	899,200
Total incremental operating costs	282,788
Total incremental costs	1,181,988
Percentage of Indonesian ownership (52.73 %)	
New total cost	623,262
Contingency (15%)	93,489
Financial fee (3%)	21,503
Grant amount	**738,254**

ANNEX D

ENVIRONMENTAL ASSESSMENT

This project will not result in any additional emissions, effluents, or wastes being produced at P.T. Lippo Melco Manufacturing's plant. This proposal has been carefully examined repeatedly and it is the best alternatives for it satisfies all applicable local environmental, health, and safety regulations. Furthermore, there is no need for a revised certificate of compliance.

ANNEX E

EQUIPMENT JUSTIFICATION

EQUIPMENT SPECIFICATION & INSTALLATION SCHEDULE

Phase I

1. Controlled Ambient Testing Room

1.1 Specification

Controlled temperature range	: 10 - 80 C ± 0.3 C
Controlled humidity range	: 20 - 95 % ± 3 % (at 30 C)
Air speed	: < 0.2 m/s
Dimension	: 4.1 x 1.9 x 2.1 m
Capacity	: 4 refrigerators
Maker	: Tabai Espec Corp.

1.2 Installation Period

October 1994 to November 1994.

2. Dryer Moisture Analyzer

2.1 Specification

Vacuum-drying system	
Oven temperature	: 320 C
Makers	: Kawamura Precision Industries Ltd.

2.2 Installation Period

October 1994 to November 1994.

3. Parts Moisture Analyzer

3.1 Specification

Vacuum-drying system	
Oven temperature	: 120 C ± 5 C
Cold trap temperature	: -30 C
Makers	: Endo-Kagaku K.K

3.2 Installation Period

August 1995 to September 1995.

4. Refrigerant and Non-condensible Gas Analyzer

4.1 Specification

Vacuum-deaerator system	
Cold trap temperature	: -30 C
Makers	: Okada

4.2 Installation Period

October 1994 to November 1994.

Phase II

5. Refrigerant Charging Machine

5.1 Specification

Four points presetting system
Charged weight range : 30 - 340 g
Makers : Toyo-Oil Machinery

5.2 Installation Period

August 1995 to September 1995.

6. Controlled Ambient Assembling Room

6.1 Specification

Dimension (LxWxH) : 22.0x4.2x3.0 m
Humidity controlled range : 70 %
Equipped with 4x17,000 Btu/h air conditioners and 2 air curtains
Makers : Indonesia maker

6.2 Installation Period

August 1995 to September 1995.

7. HFC-134a Leak Detector

7.1 Specification

Adjustable sensitivity system
Minimum sensitivity : 2 g/year
Maker : Fuso Risha Seihin

7.2 Installation Period

One unit in October 1994 to November 1994 (for development purpose), the rest in August 1995 to September 1995 (for mass production).

8. Slat Conveyor for Evacuating Line

8.1 Specification

Variable speed system
Dimension (LxWxH) : 24x0.9x0.4 m
Speed range : 0.6 - 2.5 m/s
Makers : PT Dynamica Perdana Sakti

8.2 Installation Period

August 1995 to September 1995.

9. Slat Coveyor for Testing Line

9.1 Specification

Variable speed system
Dimension (LxWxH) : 24x0.9x0.4 m
Speed range : 0.6 - 2.5 m/s
Makers : PT Dynamica Perdana Sakti

9.2 Installation Period

August 1995 to September 1995.

10. Auto Tester for Testing Line

10.1 Specification

Equipped by short circuit, running current, low voltage start, insulation resistance, dielectric strength checker, voltage auto regulator and ground conductor.

Makers : Izumi Chain for short circuit, running current, low voltage start checker, ground conductor and voltage auto regulator.
Endo Kagaku for insulation resistance and dielectric strength checker.

10.2 Installation Period

August 1995 to September 1995.

11. Quick Joint Vacuum Coupler

11.1 Specification

Type : PCV500-2 HNBR/2S-V HNBR/2P-V HNBR for HFC-134a

Makers : Nitto Kohki Co. Ltd.

11.2 Installation Period

Twenty sets between October 1994 and November 1994 (for development purpose), 50 sets between August 1995 and September 1995 (for mass production).

Indonesia

REVIEW OF A HFC-134a CONVERSION PROJECT

Manufacture of HFC-134a Appliances at PT. Lippo Melco Manuf. (LMM)

Revised Project Proposal by The World Bank, October/November 1994

RTU-UNWB-LK-94546-lk

Scope

The project under review covers the conversion from CFC-12 to HFC-134a in circuits of refrigerators and to cyclopentane in the foam. Only the HFC-134a part is reviewed here.

Technology

The HFC-134a technology selected is environmentally sound and safe. It is the most cost effective option that can be used at present. The proposal contains a phased approach for the introduction of HFC-134a, as given in OORG recommendations.

There is a technology assistance or licensing agreement for the conversion from CFC-12 to HFC-134a at a level of USD 204,000; costs associated with training should also be related to this technical assistance. If the technical assistance issue only covers the development of new models (5 models) it can be considered separately, as is done in the proposal. Compared to the production level (40,500 pieces), generally, the investment costs for model development and training are rather high; investment costs for mass production are reasonable. Adequate optimisation of the refrigerant charge of HFC-134a will be carried out.

Environmental impact

The refrigerant proposed has a no ODP. Health and safety impacts are minimised.

Project costs

Most of the components are necessary for the conversion; it concerns incremental costs since it is stated that none of the components has been installed before the conversion and is necessary for the conversion.

In general, the equipment proposed does not lead to an increase in capacity, but some effects need to be considered where there could be questionmarks. (e.g. "auto-tester").

IA1. Controlled ambient test room and moisture analysers

In principle costs for the testing room plus equipment are acceptable since a large number of model tests will be done (which is explained, it also concerns tests for foam analysis); if long term tests are involved, as in this case, costs for the room should can be considered as only incremental.

Moisture analysis is assumed to cost about USD 100,000,-. Comparable projects claim lower costs; if there is special emphasis from this factory that moisture analysis is absolutely required (as in pre-reviews of the project) costs are acceptable.

IC Training

A training component in the order of USD 90,000 is high but acceptable if this is not covered in the technical assistance.

IID Investment costs

The auto-tester (USD 120,000) will reduce manual handling, however, it is stated that this equipment is absolutely necessary for the manufacturing operation of HFC-134a. If it does not imply that there will be a reduction in personnel costs from this operation (as stated in discussions to be not more than marginal), costs are acceptable.

It should be underlined that vacuum pumps necessary for HFC-134a are retrofitted without costs.

Operating costs

Incremental operating costs observed in similar proposals are normally in the range of 2-7

USD. These are higher in this proposal.
This is mainly due to higher compressor costs. Costs for compressors should be checked once the mass manufacturing operation has been started.
There are no further comments as to operating costs.

Implementation timeframe

The implementation timeframe seems reasonable. With the assistance, however, testing and training seems to cost a considerable amount of time.

Recommendations

The HFC-134a conversion, as proposed in the project, is recommended.

Kuijpers, LJM
Eindhoven, 3 November 1994

COUNTRY	: Republic of Indonesia
PROJECT TITLE	: Elimination of ODS used in the manufacturing Household Refrigerators at PT. SANYO Industries Indonesia, Jakarta
SECTOR COVERED	: Household Refrigerator
ODS USED IN SECTOR	: 77.9 MT of CFC-12 in 1993 (73.1 MT in new appliances) 306 MT of CFC-11 in 1993. Total of 383.9 MT (383.9 ODP-weighted MT).
PROJECT IMPACT	: Eliminate annual consumption of 19.63 MT of CFC-12 and 52.75 MT of CFC-11. Total of 66.05 ODP-weighted MT annually after non ODS refrigerator production begins.
PROJECT DURATION	: Phase I : 2.5 years Phase II : 2.5 years Phase III : 4 years
PROJECT ECONOMIC LIFE	: 10 years
TOTAL PROJECT COST	: ODS Reduction Investment Cost : US$ 1.272 million Incremental Operating Cost : US$ 0.484 million Total Project Costs : US$ 1,756 million
COST-EFFECTIVENESS	: US$ 10.46/ODP-weighted kg/year
PROPOSED OTF FINANCING	: US$ 728,000 as grant (including 15 % contingency and 3% financial fee)
IMPLEMENTING ENTERPRISE	: PT. Sanyo Industries Indonesia
COORDINATING MINISTRY	: INDONESIAN STATE MINISTRY OF ENVIRONMENT
IMPLEMENTING AGENCY	: THE WORLD BANK

PROJECT SUMMARY

This project will phase out completely Ozone Depleting Substances used in household refrigerators manufactured at PT. SANYO Industries Indonesia (SII) in Indonesia.

SII itself has been constructing a completely new facility on the other location, Cikarang, about 30 kilometers eastern from Jakarta, that would be operated in February of 1995, while its production in the existing facility will be stopped in November of 1994. SII will not replace any existing production line equipment to the new facility. Since its old facility will be completely retired and its new facility will use non-CFC technology instead of CFC, SII believes it is eligible for funding from the Fund.

The project comprises three phases and will create a production line for refrigerators using HFC-134a and HCFC-141b as the new refrigerants and foam blowing agent respectively. The first phase will provide for product development using non-ODSs and will identify all equipment and process changes needed to implement the alternative technology. During this phase, SII will seek engineering assistance and training from its parent company, Sanyo Electric Co., Ltd. of Japan (SEC).

In Phase II SII will purchase and install new equipment necessary for mass production of non-CFC refrigerators. In Phase III, SII will conduct the mass production of non-CFC refrigerators which is expected can be initiated in 1997. The project will result in the elimination of 19.63 MT/year of CFC-12 (refrigerant) and 52.75 MT/year of CFC-11 (foam blowing agent) annually after the conversion is completed.

TECHNICAL ASSESSMENT

This project proposal is being submitted to the OORG reviewers for final approval. The revised proposal has addressed the concerns raised by the foam and refigeration reviewers in their preliminary.

PROJECT OBJECTIVE

The objective of this project is to retire an existing CFC-using refrigerator plant and put into operation a replacement plant that uses non-CFCs at P.T. Sanyo Industries Indonesia. The project provides for the purchase of equipment, the transfer of technology, and the training necessary to facilitate an effective transition to HFC-134a for the refrigerant and HCFC-141b as new blowing agent in polyurethane insulation foam.

SECTOR BACKGROUND

In 1993, the domestic refrigeration industry in Indonesia consumed approximately 383.9 MT of Chloro-Fluoro-Carbons (CFC) representing 3.7 percent of the country's consumption of CFC. Of the sector's total use of CFC, household appliances accounted for 77.9 MT of CFC-12, with approximately 73.1 MT used to charge new appliances during manufacture and 4.8 MT used for servicing by appliance repair shops. In addition, about 306 MT of CFC-11 were used in the production of polyurethane (PU) appliance insulation foam.

The production of household refrigerators and freezers in Indonesia has increased significantly in the past four years, from about 335,000 units in 1991 to approximately 520,100 units in 1993, from which 70,000 units were exported to Middle East, South America, and other countries. Most refrigerators sold in Indonesia made locally by eight major manufacturers : National Gobel, Sharp Yasonta Indonesia, Sanyo Industries Indonesia, Topjaya Antariksa Electronics, Lippo Melco Manufacturing, Samsung Maspion Indonesia, Goldstar Astra and Harapan Daya Utama.

Household refrigerators produced are relatively small, typically around 150 to 165 liters. The average charge of CFC-12 in refrigerators manufactured in Indonesia is around 0.140 kg. In addition an average of 0.580 kg of CFC-11 is used in making the rigid polyurethane foam in the cabinet. Since 1993 almost all refrigerator manufacturers in Indonesia have started using 20 percent CFC-11 reduced polyurethane foam formulations.

Up to now compressors demand is fulfilled by importing from other Asian countries such as Singapore (Matsushita) and South Korea (Goldstar and Samsung). This year (1994) Sanyo Compressor Indonesia has started production of reciprocating type compressors for export and later for the local market. This manufacturer is going to produce both R-12 and HFC-134a compressors up to 1997 which is the phase out of CFC set by the Indonesian government.

ENTERPRISE BACKGROUND

PT. SANYO Industries Indonesia (SII) is located on North Jakarta. Thirty five percent of the company is Indonesian-owned while the rest is owned by Sanyo Electric Co,Ltd, Japan(SEC). SII employs 200 people in its refrigerators production line and its revenues in 1993 were approximately US$ 14.8 million.

SII produced its first refrigerators in 1971 and licenses the technology from Sanyo Electric Co,Ltd of Japan. In 1993, total production was 60.820 refrigerators, consists of refrigerators and frezeers, they were domestically marketed and held about 17 % of the market. In 1995 SII will export some of its products, beyond 120,000 current capacity, to Japan, South East Asia, and Middle East countries. SII refrigerator production includes twelve different models with capacity as follows : 49 liters, 92 liters, 112 liters, 145 liters (two models), 159 litres (1 door model), 131 liters, 158 liters and 198 liters (2 door model), while the freezer includes one door model with capacity 116 liters, 143 liters, and 165 liters. SII has one production line with a total capacity of 120,000 units annualy at present .

Since March 1992 SII has used 35% reduced CFC-11 polyurethane foam formulation as a transition step towards non-ODSs technology implementation. During transition period 49.15 MT of CFC-11 can be reduced and after the elimination of ODSs it is expected that 19.63 MT of CFC-12 and 52.75 MT of CFC-11 can be saved annually. These figures are based on typical charge size of CFC-12 of 0.140 kg per unit, allowing 5% for calibration/rework and an average of 0.400 kg of CFC-11 for foam blowing agent.

Based on installed capacity of 120,000 units per year, SII has one production line which is consist of :

1. Steel cabinet and door forming line,
2. Painting line,
3. Thermoforming line,
4. Preassembly line for cabinets and doors,
5. Polyurethane foaming line,
6. Assembling line,
7. Evacuating and charging line,
8. Testing line,
9. Repairing line, and
10. Packing line.

- In polyurethane foaming line SII uses two units high pressure foaming machine from Elastogran (PU.80 types), one premixing tank for polyol and CFC-11 from Satake (H439M type). All polyurethane fixtures are on fixed position, handled manually and unheated.

- In evacuating, charging and testing line SII utilizes 44 units vacuuming pumps from Ulvac, one charging machine from Nitto, two halogen leak detectors from Toshiba, one insulation resistance tester from Yokogawa.

- For controlling production quality SII uses five units temperature recorders from Yokogawa.

SII itself has been constructing a new facility on the other location, Cikarang, about 30 kilometers eastern from Jakarta. Capacity of the new facility will be approximately 320,000 units per annum. SII expects to operate the new facility in February of 1995 while its production in the existing facility will be stopped in November of 1994. SII will not replace any existing production line equipment to the new facility.

One of Sanyo companies in Indonesia, Sanyo Compressor Indonesia, has started production of HFC-134a compressor in Cikarang for exporting and it is believed that it can supply its HFC-134a compressor to the local market in 1995. SII purchases its compressors from Sanyo Universal Electric Public Co, Ltd Thailand, and Sanyo Electric Co.Ltd, Japan. SII will purchase HFC-134a compressors from Sanyo Compressor Indonesia in 1995.

PROJECT DESCRIPTION

In this project, PT SANYO Industries Indonesia will eliminate the use of CFCs in household refrigerators by converting its manufacturing facility to one capable in handling HFC-134a and HCFC-141b as the new refrigerant and foam blowing agent respectively. The project is devided into three phases. Phase I will provide for engineering assistance, training and acquisition of specific testing equipment for non-ODS refrigerators. Phase II will allow for the elimination of ODSs through the procurement and installation of new equipment necessary for mass production of non-ODS refrigerators. Phase III will involve actual mass of non-CFC refrigerators.

Although SII constructs a completely new plant, in this project SII is only requesting fund that is specifically relating with the ODS phase out programme to cover the costs which are incurred.

The main objective of phase I consists of developing reliable new non-CFC refrigerators at SII. This task is particularly difficult to accomplish given the considerable engineering design modifications and the necessary testing that have to be done in a relatively short period of time. In order to minimize the risk associated with the conversion process, SII will request technical assistance from SEC of Japan, during this phase. This technical assistance represents continuation of existing arrangements between the two companies. SII has used similar arrangements in the past to develop its present refrigerators models.

The emphasis in phase I is to provide SII with technology developed by SEC in Japan, modifying it where necessary to account for differences in Indonesian manufacturing conditions and produced models. As part of the technical agreement, SEC of Japan will do the following :

1. Redesign the refrigerating circuit for present SII models.
2. Conduct approval testing for HFC-134a compressors.
3. Conduct approval testing for non-CFC (HFC-134a and HCFC-141b) SII refrigerators.
4. Provide training on manufacturing, quality control and maintenance of non-CFC equipment.
5. Provide production drawing for non-CFC SII refrigerators.

SII requests additional fund for Phase I to procure the following main machinery and equipment:

1. A controlled ambient testing room with data acquisition system as the HFC-134a and HCFC-141b prototypes should be tested under specific ambient. At present SII has one unit of this equipment, which then will be allocated for performance life testing. However for this project SII will need one additional testing room for continuously testing on the non-CFC refrigerators; for durability test will need a minimum period of 2 years. <u>Realizing that testing room can be used for considerably longer period after initial testings, SII will take the future functions into account in the funding request, i.e. about 80 % of price quoted</u>.

2. A moisture gauge to confirm that moisture content in new supplied dryer is within design specification, also to confirm the quality consistency of new supplied refrigeration circuit components, except dryer, in terms of their moisture content.

These equipment to be used for testing the prototype and its components in phase I and in Phase III to ensure that they are manufactured according to design specifications.

Phase II will consist of finalizing the transition from CFCs technology to nom-CFCa in mass production. During this period SII will install :

1. A charging machine which is capable of handling HFC-134a. Present facility still be used to handle CFC-12 during transition period and cannot be

retrofitted to handle HFC-134a because already contaminated by chlorine and some components in the charging machine are made of materials incompatible with HFC-134a. .

2. An air conditioned assembling line to keep ambient humidity on 70%. HFC-134a compressor will be supplied with ester oil in it while present humidity inside factory is 85%.

3. 3 units HFC-134a leak detectors because the engitivity of existing ones is too poor for detecting HFC-134a leakage.

4. 3 units R-1800 12 dot recorder to monitor and record the temperature at specific point in one unit of refrigerator. During the peak periode 12 sets of refrigerators will be tested together . These recorders will be used for testing and monitoring the cooling performance of random sampling of refrigerators and freezers.

5. 1 unit oven to increase temperature in foaming process up to 40 $^{\circ}C$. Currently chemical used (CFC-11) has a boiling temperature of 23 $^{\circ}C$, but the new chemical (HCFC-141b) has a boiling temperature of a 32 $^{\circ}C$. Realizing this condition SII needs to preheat the doors and cabinets to a temperature of at least 40 $^{\circ}C$ prior to polyurethane charging in order to get a good reaction time and avoid the possibility of defects. At present SII has one oven, and in this project SII is only addressing the modification on current oven.

6. SII will purchase and install two polyurethane charging machines.

In phase III, SII will conduct mass production of non-CFC refrigerators at SII in Cikarang, will be started in 1997.

Realizing HCFC-141b is still ODS, with low ODP, SII will implement the non-ODS technology on the new facility. Long-term options are still being researched and that the most promising of these is cyclo-pentane, but no decision has been made yet, and SII will likely adopt non-ODS foaming technology once its parent company has sufficient experince with non-ODS foams. As the final decision has been made, SII will submit another proposal for the investment of non-ODS technology.

For after-sales services, the investment of non-ODS technology will be submitted after Phase II is finished, also in another proposal.

JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY.

Internationally, HFC-134a has been accepted as the alternative refrigerant to replace CFC-12 in household refrigerators. Hydrocarbons can also be used as refrigerants, but they are flammable and hydrocarbon compressors are not yet commercially available. HFC 134-a has no ODP, low GWP, good thermodynamic properties, and non-falammable substance. Several manufacturers of compressors and household appliances have announced their intention to convert from CFC-12 to HFC-134a based household refrigerators.

As earlier mentioned SII is already using a reduced CFC-11 (35 %) polyurethane foam formulation. Low CFC-11 formulations have already been used in developed countries and are relatively simple to implement.

Many different alternative blowing agents to replace CFC-11 are being developed such as HCFC-141b, HCFC-22, HCFC-22/HCFC-142b, HFC-134a and cyclopentane. SII has decided to use HCFC-141b as the short-term solution. HCFC-141b has a similar boiling point with CFC-11 and therefore requires minimal modifications in process. Thermal conductivity of HCFC-141b is almost similar with CFC-11. SII will rely on Sanyo Electric Co. Ltd., Japan for the design of non-ODS refrigerators to reduce the risks associated with the conversion process.

PROJECT COSTS

As described below and detailed in the relevant annexes, **the total project cost** is US$ 1,755,631. This project is aimed entirely at ODSs elimination, as a result the total project cost is equal to the ODS reduction project cost. This project will not provide SII with any incremental operating revenue.

As detailed in Annex A, **the net incremental capital costs** for this project is US$ 1,271,565. Major components of the costs include costs associated with equipment procurement, non-ODSs refrigerators product development, technical assistance from Sanyo Electric Co. of Japan, prototype testing and training.

In calculating the operating cost, it is taken into account that SII produces 86,520 refrigerators in 1994. The operating cost is computed based on the production in the 1st half year (6 months), regardless of SII future expansion. This is consistent with the Executive Committee's guidelines which state that the Multilateral Fund should not recover costs associated with plant expansion.

Incremental operating cost results from the increased cost of raw materials such as compressors, dryers, contaminant filters, condensor pipes, refrigerant and polyurethane foam for the HFC-134a/HCFC-141b system.

Given a discount rate of ten percent (10%), the net present value of incremental operating costs minus the offsetting savings for the ten year project life is equal to US$ 484,066. A more detailed breakdown of operating costs is provided in Annex B.

As derived in Annex C, **the unit abatement cost**, for CFC-12 and CFC-11, is US$ 10.46 per ODP-weighted kg. This amount is the summation of the annual incremental capital cost of US$ 206,941 and annual net incremental operating cost of US$ 484,066 million then the total incremental cost is divided by the total annual savings of 66,050 kg ODPs.

A grant requested from the OTF is the amount of US$ 727,841 was calculated as follows : the net incremental capital cost was added to the net present value of the incremental operating cost over the six months production in 1994. Then the total incremental cost was multiplied by the percentage of Indonesia ownership (35 %), the result was then added to 15% (contigency) of itself and finally the amount is added to 3% (financial fee) of itself to yield the ultimate grant amount.

The 15 percent cont.gency is required to ensure that the implementing enterprise still receives adequate compensation in cases which the actual cost of items listed in this proposal exceeds their estimated cost.

Schedule

Task	1993	1994	1995	1996	1997	1998
Phase I						
- Technical assistance, Model development of HFC-134a and HCFC-141b	xxxx	xxxx	xx			
- Training and Testing		xxxx	xx			
- Equipment ordering		xxxx	xx			
Phase II						
- Procurement and equipment Installation		xx	xxxx	xxxx		
- Convertion of production line to HFC-134a and HCFC-141b			xxxx			
- Mass production of HFC-134a and HCFC-141b refrigerators					xxxx	xxxx

Note : x = one quarter of a year

REQUIRED REGULATORY ACTIONS

No regulatory actions, other than routine permitting, are required to implement this project. Under existing agreement with the World Bank, equipment and machinery imported as a part of this project will be exempt from import duties levied by the Indonesian Government.

RESULTS

Direct Project Impacts

This project will phase out 19.63 MT/year of CFC-12 and 52.75 MT/year of CFC-11 from PT. Sanyo Industries Indonesia process after full-scale production of non-CFC refrigerators starts in 1997. In total approximately 66.05 ODP-weighted MT of ODP per year will be eliminated.

Indirect Project Impacts

This project will not impact product quality or reliability but will likely affect product price. The environment impacts associated with this project are expected to be negligible.

ANNEX A

CAPITAL COSTS

(estimated costs in US dollar)

<u>Phase I</u>

A.	Investment Cost for Model Development						US$	378,544
	1.	Ambient controlled testing room		(1 unit)	US$	120,000		
	2.	Portable refrigerant charger		(1 unit)	US$	7,884		
	3.	R-1800 12 dot recorder		(2 units)	US$	10,660		
	4.	Moisture gauge		(2 units)	US$	24,000		
	5.	Technical assistance from Sanyo Electric Co. of Japan, consists of :			US$	216,000		
		- Redesign fee for 12 models	US$	120,000				
		- Research and development	US$	96,000				
B.	Costs Associated with Testing of Refrigerators						US$	107,700
	1.	Prototype :			US$	18,600		
		Number of models	12					
		Number of prototype per model	5					
		Cost per unit, average	US$	310				
	2.	Pre-pilot production trials :			US$	89,100		
		Number of models	11					
		Number of units per model	20					
		(4 sets for performance and noise test, 4 sets for determining injected PUF weight, 4 sets for PUF shrinkage test, 4 sets for heat cycle test, and 4 sets for contaminant effect test)						
		Material cost per unit, average	US$	310				
		Labor cost per unit, average	US$	95				
C.	Costs Associated with Training and Consulting						US$	77,950
	1.	SII's engineers dispatch to Japan (2 persons)			US$	13,500		
		Number of days	30					
		Cost per day	US$	150				
		Air ticket / person	US$	2,250				
	2.	SII's technicians dispatch to Japan (2 persons)			US$	13,500		
		Number of days	30					
		Cost per day	US$	150				
		Air ticket / person	US$	2,250				

3.	**Assistance from SEC, Japan**				US$	50,950	
	– **In Development :**			US$	29,250		
	Number of SEC's engineers	3					
	Number of days	45					
	Cost per day	US$	200				
	Air ticket / person	US$	2,250				
	– **In Quality Control :**			US$	8,250		
	Number of SEC's engineers	2					
	Number of days	15					
	Cost per day	US$	200				
	Air ticket / person	US$	2,250				
	– **In Confirming and Directing :**			US$	13,450		
	Number of SEC's engineers	2					
	Number of days	28					
	Cost per day	US$	200				
	Air ticket / person	US$	2,250				

Total Investment Costs in Phase I US$ 564,194

Phase II

D. Investment Costs for Mass Production US$ 707,371

	Refrigeration System			US$	233,492
1.	Ambient controlled assembly line			US$	17,535
	– A/C (indoor unit)	(3 units)	US$ 3,025		
	– A/C (outdoor unit)	(3 units)	US$ 3,422		
	– air filter	(9 units)	US$ 11,088		
2.	Refrigerant charging machine		(1 unit)	US$	90,000
3.	Pipe pinching tool		(2 units)	US$	10,694
4.	Vacuuming pump		(44 units)	US$	0
5.	Oil purifier		(1 unit)	US$	0
6.	HFC-134a leak detector		(3 units)	US$	25,665
7.	R-1800 12 dot recorder		(3 units)	US$	15,741
8.	Quick joint vacuum coupler A		(100 units)	US$	3,288
9.	Quick joint vacuum coupler B		(300 units)	US$	15,408
10.	Quick joint vacuum coupler C		(300 units)	US$	19,866
11.	Vacuum pallet/base		(80 units)	US$	31,236
12.	Hose nipple		(82 units)	US$	2,309
13.	Vacuum hose		(82 units)	US$	1,750
14.	Testing line		(1 unit)	US$	0
	Foam Insulating System			US$	473,879
1.	Mixing stationary		(2 units)	US$	48,000
2.	Modification on current oven		(1 unit)	US$	163,613
3.	Modification on current foam test equipment		(1 unit)	US$	0
4.	High pressure polyurethane charging machine (1 unit for cabinet and 1 unit for door)		(2 units)	US$	262,266

Total Investment Costs in Phase II US$ 707,371

Total Investment Costs (Phase I and Phase II) *US$ 1,271,565*

ANNEX B

INCREMENTAL OPERATING COST

(estimated costs in US dollar)

The caculation of incremental cost is based on six months production in 1994.

1. Production

1.1. Projected Production (based on 1994, and estimated increase 20 % per year)

Model		Volume (liter)	Production (units) 1997	1998	1999	2000	Total (units)
1 door	SR 50	50	8,295	9,954	11,945	14,334	44,528
	SR 90	90	11,716	14,059	16,871	20,245	62,891
	SR 148	113	43,425	52,110	62,532	75,038	233,105
	SR 160	145	3,491	4,190	5,028	6,034	18,743
	SR 168	159	6,515	7,818	9,382	11,258	34,973
	SR F 14	145	49,715	59,658	71,590	85,908	266,871
2 door	SR 2150	131	4,147	4,977	5,973	7,168	22,265
	SR 20 A	198	691	829	995	1,194	3,709
Freezer	HF 1208	116	8,726	10,471	12,565	15,078	46,840
	HF 1508	143	9,193	11,032	13,238	15,886	49,349
	HF 1808	165	3,594	4,313	5,176	6,211	19,294
Projected Production			149,508	179,411	215,295	258,354	802,568

1.2. Production Quantity for Six Months in 1994

Model	Volume (liter)	Production (units) 1 year	6 months
SR 50	50	4,800	2,400
SR 90	90	6,780	3,390
SR 148	113	25,130	12,565
SR 160	145	2,020	1,010
SR 168	159	3,770	1,885
SR F 14	145	28,770	14,385
SR 2150	131	2,400	1,200
SR 20 A	198	400	200
HF 1208	116	5,050	2,525
HF 1508	143	5,320	2,660
HF 1808	165	2,080	1,040
TOTAL		86,520	43,260

2. Incremental Operating Cost per Unit

2.1. Refrigerant Circuit

Model	Cost per Unit								
	Compressor		Refrigerant		Dryer		Piping		Incr.
	Now	New	Now	New	Now	New	Now	New	Cost
SR 50	33.41	38.08	0.12	0.46	0.59	0.95	0.74	2.58	7.21
SR 90	33.75	38.48	0.22	0.83	0.59	0.95	1.34	3.17	7.53
SR 148	34.09	38.86	0.27	1.02	0.59	0.95	1.37	3.20	7.71
SR 160	34.09	38.86	0.30	1.16	0.59	0.95	1.55	3.38	7.81
SR 168	34.09	38.86	0.35	1.34	0.59	0.95	2.53	4.36	7.95
SR F 14	34.09	38.86	0.35	1.34	0.59	0.95	1.55	3.38	7.95
SR 2150	34.77	39.64	0.34	1.29	0.59	0.95	2.19	4.02	8.01
SR 20 A	35.47	40.44	0.27	1.02	0.59	0.95	3.56	5.39	7.91
HF 1208	35.47	40.44	0.40	1.53	0.61	0.97	2.40	4.23	8.29
HF 1508	48.05	54.78	0.49	1.85	0.61	0.97	2.67	4.50	10.28
HF 1808	60.64	69.13	0.58	2.22	0.61	0.97	3.05	4.83	12.27

2.2. Insulation Foam (HCFC-141b)

Model	Cost per Unit						Incr.
	PUF Material				ABS Sheeting		
	Polyol		Isocyanate				
	Now	New	Now	New	Now	New	Cost
SR 50	0.99	1.06	0.75	0.81	1.31	2.55	1.38
SR 90	1.49	1.62	1.14	1.27	2.35	4.60	2.51
SR 148	1.94	2.10	1.48	1.61	3.33	6.16	3.12
SR 160	2.13	2.36	1.90	2.10	4.21	7.09	3.31
SR 168	2.66	2.89	2.02	2.22	5.91	9.11	3.63
SR F 14	2.13	2.35	1.90	2.09	4.21	7.10	3.31
SR 2150	2.74	2.96	2.09	2.28	3.77	6.98	3.62
SR 20 A	5.21	2.58	3.96	4.29	7.44	11.27	1.52
HF 1208	3.14	3.38	2.39	2.60	3.70	6.46	3.20
HF 1508	3.29	3.57	2.51	2.74	4.16	6.91	3.26
HF 1808	3.59	3.90	2.73	3.00	6.15	10.08	4.52

2.3. Incremental Operating Cost for Six Months Production in 1994

Model	Incr. Cost per Unit			Incr. Cost for 6 months
	HFC-134a	HCFC-141b	Incr. Cost	
SR 50	7.21	1.38	8.59	20,609
SR 90	7.53	2.51	10.04	34,046
SR 148	7.71	3.12	10.83	136,079
SR 160	7.81	3.31	11.12	11,233
SR 168	7.95	3.63	11.58	21,825
SR F 14	7.95	3.31	11.26	161,946
SR 2150	8.01	3.62	11.63	13,961
SR 20 A	7.91	1.52	9.43	1,886
HF 1208	8.29	3.20	11.49	29,000
HF 1508	10.28	3.26	13.54	36,024
HF 1808	12.27	4.52	16.79	17,457
TOTAL INCREMANTAL COST				484,066

3. NPV Incremental Operating Cost

NPV Incremental Operating Cost : 484,066

ANNEX C

UNIT ABATEMENT COST and PROPOSED OTF FINANCING

(estimated costs in US dollars)

1. ODS Saving

Average annual ODSs saved was based on ODSs consumption in 1997 production, i.e. :

CFC-11 saved, kg	52,747
CFC-12 saved, kg	19,633
ODSs saved, kg	72,380
ODPs saved, kg	66,050

2. Net Incremental Capital Costs

Overall project life, year	10	
Discount rate/year	10%	
Total incremental capital costs		1,271,565
Annualized incremental capital costs		206,941

3. Net Incremental Operating Costs

Overall project life, year	10	
Discount rate/year	10%	
Total incremental operating costs requested		484,066
Annualized incremental operating costs		484,066

4. Unit abatement cost

	Cost/year	Unit cost/kg ODP saved
Annualized incremental capital costs	206,941	3.13
Annualized incremental operating costs	484,066	7.33
Total unit abatement cost		10.46

5. Proposed OTF Financing

Net incremental capital costs	1,271,565
Total incremental operating costs	484,066
Total incremental costs	1,755,631
Percentage of Indonesian ownership (35 %)	
New total cost	614,471
Contingency (15%)	92,171
Financial fee (3%)	21,199
Grant amount	**727,841**

ANNEX D

ENVIRONMENTAL ASSESSMENT

This project will not result in any additional emissions, effluents, or wastes being produced at PT. SANYO Industries Indonesia's plant. It is the best judgement of the project proposal team that the project will meet all aplicable Indonesian Government environmental, health, and safety regulations and will not trigger the need for a revised certificate of complience.

Indonesia

REVIEW OF A HFC-134a CONVERSION PROJECT

Manufacture of HFC-134a Appliances at Sanyo Ind. Indonesia (SII)

Revised Project Proposal by The World Bank, October/November 1994

RTU-UNWB-LK-94548-lk

Scope

The project under review covers the conversion from CFC-12 to HFC-134a in circuits of refrigerators and the conversion from CFC-11 to cyclopentane. Only the HFC-134a part is reviewed here.

Technology

The HFC-134a technology selected is environmentally sound and safe. It is the most cost effective option that can be used at present. The proposal contains a phased approach for the introduction of HFC-134a, as given in OORG recommendations.

There is a technology assistance or licensing agreement for the conversion from CFC-12 to HFC-134a; taking into account the amount (USD 216,000); costs associated with training could also relate to this technical assistance agreement. If the costs for the technical assistance do not cover the consulting (as can be taken from the proposal), it can be considered separately. Compared to the production level (60,000 pieces), generally, the investment costs for model development, the training and consultancy component, and the investment costs for mass production are rather high (see further below).

Adequate redesign and optimisation of the refrigerant charge will be carried out; new HFC-134a production will be of high quality.

Environmental impact

The refrigerant proposed has a no ODP. Health and safety impacts are minimised.

Project costs

Most of the components are necessary for the conversion.

Costs for a controlled testing room (including measuring equipment) are in-line with costs that can be expected.

IB. Costs associated with testing

Pre-pilot test costs are rather high, however for the prototype testing of the refrigeration part a relatively low amount is claimed (USD 310 as cost per unit is reasonable).

IC. Training and IID. Investment costs

The training component is related to a wide scale of activities; no further comments as to the set up and costs. The investments costs as given are detailed enough; for a number of issues no amount is claimed. No further specific comments to the investment proposal.

Operating costs

Incremental operating costs observed in similar proposals are normally in the range of 2-7 USD. These are higher in this proposal, but this is mainly due to the increase in cost for the compressor. Costs should be checked when mass production has been started.

No further comments as to operating costs.

Implementation timeframe

The implementation timeframe seems reasonable. With the assistance, the model development seems to cost a considerable amount of time (2 1/2 years).

Recommendations

The HFC-134a conversion, as proposed in the project, is recommended.

Kuijpers, LJM

Eindhoven, 3 November 1994

INDONESIA - PT SANYO INDUSTRIES

TECHNOLOGY

The project covers the conversion of foam insulation for refrigerators / freezers from CFC 11 to HCFC 141b. This is now a well proven technology and the enterprise will receive technical support from its parent company Sanyo. This is especially important to cover issues such as grades of plastic liners which are compatible with the new blowing agent.

The enterprise has considered other options, including those of zero ODP. It is not yet ready for a one step conversion to an option such as cyclopentane. However, the new dispensing equipment which is proposed would be capable of modification for use with such a flammable blowing agent.

ENVIRONMENTAL ISSUES

HCFC 141b is recognised as a transitional blowing agent by the enterprise since it does not have a zero ODP. It is considering zero ODP replacements for eventual replacement and the proposed equipment would be capable of modification for use with flammable alternatives.

HCFC 141b is moderately flammable and the enterprise should ensure that adequate ventilation is provided.

PROJECT COSTS

The foam-related items are justified and necessary for the technology choice. The UAC related to foam capital items is ca. 1.5 $/kg which is cost effective for a small enterprise taking into account the purchase of new dispensing equipment.

The operating cost calculation is transport and reasonable.

IMPLEMENTATION TIMEFRAME

This is acceptable.

RECOMMENDATION

Approved.

GMFJ/kd/4/11/94

COUNTRY	: Republic of Indonesia
PROJECT TITLE	: Elimination of Ozone Depleting Substances Used in the Production of Household Refrigerators at P.T. Sharp Yasonta Indonesia.
SECTOR COVERED	: Household Refrigerators
ODS USE IN SECTOR	: 77.9 MT of CFC-12 in 1992 (73.1 MT in new appliance) and 306 MT of CFC-11 in 1993 Total of 383.9 MT (383.9 ODP - weighted MT).
PROJECT IMPACT	: Limination annual consumption of 38.4 MT of CFC-12 and 134.3 MT of CFC-11. Total of 172.7 ODP - weighted MT one year after non-ODS refrigerator production begins.
PROJECT DURATION	: Phase I : 2.5 years Phase II : 1.5 years Phase III : 4.0 years
PROJECT ECONOMIC LIFE	: 10 years
TOTAL PROJECT COST	: ODS Reduction Investment Cost : US$ 4.234 million Incremental Operating Cost : US$ 0.423 million Total Project Costs : US$ 4.657 million
COST EFFECTIVENESS	: US$ 6.44 / ODP-weighted kg.
PROPOSED OTF FINANCING	: US$ 2,693,000 as grant (including 15% contingency and 3% financial fee)
IMPLEMENTING ENTERPRISE	: P.T. Sharp Yasonta Indonesia
COORDINATING MINISTRY	: Indonesia State Ministry of Environment
IMPLEMENTING AGENCY	: The World Bank

PROJECT SUMMARY

This project will phase out completely Ozone Depleting Substances used in household refrigerators manufactured at P.T. Sharp Yasonta Indonesia (SYI) in Indonesia. The project comprises three phases and will convert the production line to handle refrigerators using HFC-134a and cyclo-pentane as the new refrigerant and foam-blowing agent respectively. The first phase will provide for product development using non-ODS and will identify all equipment and process changes needed to implement the alternative technology. During this phase, SYI will seek engineering assistance and training from its licensed company, Sharp Corporation of Japan.

In phase II SYI will purchase and install new equipment necessary for mass production of non-CFC refrigerators. Mass production of some models will start in phase II.

In phase III SYI will completely eliminate ODS in the production. This phase is expected to start in 1996. The project will result in the elimination of 38.4 MT/year of CFC-12 (refrigerant) and 134.3 MT/year of CFC-11 (foam blowing agent) annually after the conversion is completed.

Since distribution and service of SHARP products is being handled by a separate company SYA (a subsidiary of SYI), a separate project proposal for converting the service centers to handle non-ODS will be submitted at a later date before SYI begin mass production of the non-ODS refrigerators.

TECHNICAL ASSESSMENT

This project proposal is being submitted to the OORG reviewers for final approval. The revised proposal has addressed the concerns raised by the foam and refrigeration reviewers in their preliminary reviews.

PROJECT OBJECTIVE

The objective of this project is to retire an existing CFC-using refrigerator plant and put into operation a replacement plant that uses non-CFCs at P.T. Sharp Yasonta Indonesia. . The project provides for the purchase of equipment, the transfer of technology, and the training necessary to facilitate an effective transition to HFC-134a for the refrigerant and cyclopentane as new blowing agent in polyurethane insulation foam.

SECTOR BACKGROUND

In 1993, the domestic refrigeration industry in Indonesia consumed approximately 383.9 MT of Chloro-Fluoro-Carbons (CFC) representing 3.7 percent of the country's consumption of CFC. Of the sector's total use of CFC, household appliances accounted for 77.9 MT of CFC-12, with approximately 73.1 MT used to charge new appliances during manufacture and 4.8 MT used for servicing by appliance repair shops. In addition, about 306 MT of CFC-11 were used in the production of polyurethane (PU) appliance insulation foam.

The production of household refrigerators and freezers in Indonesia has increased significantly in the past four years, from about 335,000 units in 1991 to approximately 520,100 units in 1993, from which 70,000 units were exported to Middle East, South America, and other countries. Most refrigerators sold in Indonesia made locally by eight major manufacturers : National Gobel, Sharp Yasonta Indonesia, Sanyo, Topjaya, Lippo Melco, Samsung, Goldstar Astra and Harapan.

Household refrigerators produced are relatively small, typically around 150 to 165 liters. The average charge of CFC-12 in refrigerators manufactured in Indonesia is around 0.140 kg. In addition an average of 0.580 kg of CFC-11 is used in making the rigid polyurethane foam in the cabinet. Since 1993 almost all refrigerator manufacturers in Indonesia have started using 20 percent CFC-11 reduced polyurethane foam formulations.

Up to now compressors demand is fulfilled by importing from other Asian countries such as Singapore (Matsushita) and South Korea (Goldstar and Samsung). This year (1994) Sanyo has started production of reciprocating type compressors for export and later for the local market. This manufacturer is going to produce both R-12 and HFC-134a compressors up to 1997 which is the phase out of CFC set by the Indonesian government.

ENTERPRISE BACKGROUND

P.T. Sharp Yasonta Indonesia is located northeast of Jakarta near Pulogadung Industrial Estate. P.T. YASONTA with 100% local ownership was established in 1970 as a production base for SHARP's consumer electronic and home appliances in Indonesia. In July 1994 a joint venture company P.T. SYI was formed between SHARP corporation of Japan and YASONTA. The new company is P.T. SHARP YASONTA INDONESIA. Starting July 1994, Sharp Corporation of Japan own 63.75% share of the new joint venture, but the composition will change in 1995 such that SHARP will own 51% of the joint venture (49% local ownership). SYI employs 950 people of which around 390 work in its refrigerator division and its division revenues in 1993 was approximately US$ 22,0 million.

YASONTA (now SYI) produced its first refrigerator in 1974 under license from SHARP Co. of Japan. In 1993 total production was 79,000 refrigerators, representing about 17% domestic market share. SYI refrigerators production includes eight different models : 127 liters, 158 liters, 179 liters (1 door models); 167 liters, 180 liters, 200 liters (2 doors model); 115 liters and 170 liters (freezer model). SYI has one production line with a capacity of around 120,000 units/shift annually. In 1994 SYI expects to produce 115,000 units refrigerators and freezers. <u>(Actual production Jan. '94 - Sept. '94 is 82,151).</u>

SYI purchases its compressors from <u>Matsushita</u> Co. (Singapore) and <u>Goldstar Co</u>. (South Korea). Since these Asian compressor manufacturers are relatively late in developing the non-CFC compressors. SYI has more confident in and plans to use <u>Zanussi</u> HFC-134a compressors for at least the first few year after conversion. <u>ICI</u> has been the supplier for SYI (YASONTA) in PU materials, blowing agent and refrigerant.

Since 1992 SYI has been using reduced CFC-11 (20%) polyurethane foam formulation from ICI as a transition step towards non-ODS technology implementation. (Reduced CFC as compare to other formulation such as TAKEDA and MITSUI which is popular in Indonesia.) During the transition period 50 MT of CFC-11 can be saved. After the full conversion in 1996 it is expected that the use of 651 MT of CFC-12 and 2,308 MT of CFC-11 can eliminated. These figures are based on typical charge size of CFC-12 as 0.15 kg and 0.55 kg of CFC-11 as a foam blowing agent per unit. A more detailed breakdown of CFC Usage at SYI is provided in Annex A.

At the present SYI has <u>two ELASTOGRAN PU machines (PU-80)</u> for the foaming of refrigerator body (between steel cabinet and inner liner). These machines was installed around eight years ago but are still in very good condition. In addition SYI has one CANNON PU machine (H40R-F2) for the doors' foaming line. This machine was installed three years ago. No oven is needed for the curing of the present PU lines. Since SYI buy the Polyol premixed with the CFC-11, mixing equipment is not necessary for the current PU system. In assembling and finishing area SYI has the following equipment :

* 70 vacuum pumps (10 among them in standby).

* 1 automatic vacuum and charging machine (Galileo DIGIFIL A150F).

* 2 Halogen leak detectors.

For the normal development and QC sampling check, SYI has one **ambient controlled testing room** which can test 6 refrigerators concurrently. There is also a **Halogen leak detector** used by QC department.

PROJECT DESCRIPTION

In this project, P.T. Sharp Yasonta Indonesia (SYI) will eliminate the use of all ODS in household refrigerators by converting its manufacturing facility to one capable in handling HFC-134a and Cyclo-Pentane as the new refrigerant and foam blowing agent respectively. The project is divided into three phases. The first phase will provide for engineering assistance, training and acquisition of specific testing equipment necessary for the development of the non-ODS refrigerators. The second phase will provide for procurement, installation and testing of non-ODS mass production equipment, and the conversion of the production line. The second phase will also involve starting production of some models with non-ODS technology. [With limited manpower in Engineering both at SYI and SHARP, production of non-CFC models will be done model by model as soon as the approval is received.] The complete elimination of CFC will be done in the third phase. The technology will be reevaluated and modified or improved if necessary.

The main objective of phase I consists of developing reliable new non-ODS refrigerators at SYI. This task is particularly difficult to accomplish given the considerable engineering design modifications and the necessary testing that have to be done in a relatively short period of time. In order to minimize the risks associated with the conversion process, SYI will request technical assistance from the principal, Sharp Co. of Japan, during this phase. This technical assistance represents a continuation of existing arrangements between the two companies. SYI has used similar arrangements in the past to develop its present refrigerator models.

The emphasis in phase I is to provide the Indonesian partner with technology developed by SHARP in Japan, modifying it where necessary to account for differences in Indonesian manufacturing conditions and produced models. As part of the technical agreement, Sharp Corporation of Japan will do the following :

1. Redesign the refrigerating circuit for present SYI models.

2. Conduct approval testing for HFC-134a compressors.

3. Conduct approval testing for non-CFC (HFC-134a and cyclo-pentane) SYI refrigerators.

4. Provide training on manufacturing, quality control and maintenance of non-CFC equipment.

5. Provide production drawings for non-CFC SYI refrigerators.

Additional funding requested in the proposal for phase I will be used to procure a controlled ambient test room with data acquisition system, dryer moisture analyzer, parts moisture analyzer and refrigerant/non condensable gas analyzer in order to test the refrigerator parts/units and ensure that they are manufactured according to design specifications. Final decisions and process changes required to implement the alternative technology will be made at the end of phase I. **Since preliminary testing of the prototype will be done at SYI, SYI will need (2) additional test rooms, one in the Engineering Department for development, the other one for Q.C. in production line. (The current test room is fully loaded for routine testing by QC and Engineering and cannot handle the additional load for the non-CFC models). However considering the fact the Engineering test room will only be needed for the development period. SYI is requesting grant for (1) test room only.**

Phase II will consist of finalizing the transition to non-CFC technology for mass production. During this period SYI will purchase <u>charging equipment</u> capable in handling HFC-134a. Moisture content of the refrigerating circuit will be minimized by means of new <u>high level vacuum pumps (SYI does not request funding for these pumps).</u> Manufacturing of HFC-134a refrigerators should be done on higher quality level than CFC-12 refrigerators, because of the water absorbing properties of HFC-134a and its associated lubricant. Therefore a <u>controlled ambient assembly line and testing line</u> will be required. For quality assurance <u>HFC-134a leak refrigerant detectors and QC sample test room</u> will be purchased **(SYI only request grant for 1 testing room).**

In this phase, SYI will also purchase and install the new cyclo-pentane foaming machines. A new generation of high pressure foaming machines capable of handling cyclo-pentane and a fire and explosion protection system will be installed. **Retrofit of the current machines has been considered, but was rejected mainly for safety consideration. It is also impossible to stop production for a period of time (estimated to be more than one month) in order to do retrofit. In a growing market that is very competitive, it will mean losing share to our competitors if we have to stop production for retrofit.** SYI will use only C-pentane blown foam as soon as the equipment is properly installed and commissioned. Production using 134a for some of the models already redesigned, tested and approved will be done in phase II. A more detail justification on equipment is included in annex F.

In order to achieve smooth transition to the new technology and safe operation thereafter. The production manager will be sent to SHARP plant in Japan to receive further briefing on the new technology. Manager of Engineering with one of the engineer has received training in Japan. Two more technicians will be sent to SHARP to be trained especially in the production technology. Before conversion SYI will brief all employee in the Appliance Division on the new technology, special emphasis will be given on the safety issue of the new C-Pentane usage. All operators in the PU area will received formatl training by the Engineering department and PU equipment manufacturers.

For safety consideration we will follow SHARP's instruction on layout design, process standard, training procedure, and equipment procurement.

In phase III SYI will complete the elimination of using CFC in its production line. All the models will be produced with non-ODS technology.

NOTE : Most of the equipment that SYI uses at the present are in very good condition but has minimum book value (mostly zero). SYI plan to donate the replaced equipment to educational institutions or other non-profit organizations. In the case that we cannot find any such organization interested in these equipment, SYI will sell them at whatever price we can get and offset the amount of reimbursement requested from the grant.

JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY

HFC-134a has a zero ODP level and has been accepted as the alternative refrigerant to replace CFC-12 in household refrigerators. Several manufacturers of compressors and household appliances have announced their intention to convert from CFC-12 to HFC-134a system. Therefore selection of 134A as non-ODS alternate is the most logical choice. The use of Iso-butane cooling system is not considered because all the compressor manufacturers in Asia are developing HFC-134A compressors only.

As earlier mentioned P.T. Sharp Yasonta Indonesia (SYI) is already using a reduced CFC-11 (20%) polyurethane foam formulation. Low CFC-11 formulations have already been used in industrialized countries and are relatively simple to implement. SYI gets its present formulation from ICI (chemical supplier).

Many different alternative blowing agents to replace CFC-11 has been considered such as HCFC-141b, HCFC-142b, HCFC-22, HFC-134a and cyclo-pentane. These technology has been investigated by the corporations and research facilities in the industrialized countries. Among those alternatives, 141b, and other HCFCs are still ODS (with lower ODP) and therefore only interim solution. HFC-134A is probably too expensive for use in mass production. The only viable final solution seems to be C-Pentane. Among the manufacturers in Japan, almost all have chosen or are seriously investigating C-pentane (or combination with Vacuum Insulation Panels) as the final solution. Some manufacturers are converting in two steps and are using the interim alternatives. Following the step of SHARP corporation which already uses C-Pentane, SYI has decided to use cyclo-pentane directly rather than doing the phase out in two steps. This is because SYI feels that this technology is mature and currently available. Beside, Electrolux which is the biggest manufacturer of domestic refrigerators is also converting all their plants to C-Pentane. SYI will rely on its principal, SHARP Co. of Japan for the new technology. In addition SYI also obtained information from the chemical manufacturers, equipment manufacturers and Electrolux for c-Pentane technology. BASF, ICI and DOW are being considered as the supplier of new PU chemical. (SYI is currently using ICI formulation. We would prefer to continue using ICI, unless the other makers can offer better formulation.)

PROJECT COSTS

As described below and detailed in the relevant annexes, the **total project cost** is US$ 4,657,477. Because this project is aimed only for the elimination of ODS used, and only provide 10% of capital cost to offset the actual incremental cost which is surely much larger. This project will not provide SYI with any incremental revenues.

As detailed in Annex B, the **net incremental capital cost** for this project is US$ 4,234,070. Major components of the costs include costs associated with equipment procurement, non-ODS refrigerator product development, techni cal assistance from Sharp Co. of Japan, prototype testing and training.

An important considering in calculating **estimated operating costs** is that SYI has capacity of 120,000 refrigerators per shift. Refrigerator production's plan of SYI in 1994 is 115,000 units. By improving efficiency, line balance, and eliminating bottle neck condition in production line, and running more than one shift. Assume 20% increasing of production per year in fulfilling market demand SYI will expect to produce approximately 290,000 units in 1999. *The equipment, machineries requested in this proposal are not meant for plant expansion.*

Incremental operating costs result from the increased cost of raw materials such as compressor, drier, contaminant filter, condenser pipe, refrigerant, and polyurethane foam. *The estimated incremental operating cost for four years is US$ 7,550,729 (ANNEX C). However as suggested by ICF, SYI only request 10% of incremental capital cost to cover for the incremental operating cost.* As derived in Annex D, the **unit abatement cost** for this project is **US$ 6.44** per ODP- weighted kg phased out per year. This number is derived from annualized incremental capital costs of US$ 689,075, annualized net incremental operating costs of US$ 68,908 and annual savings of 172,7 ODP weighted MT of CFC-11 and CFC-12 per year.

(The actual estimated NPV of incremental operating cost for 4 years is 7,550,729 as provided in ANNEX C. However SYI is here requesting only 10% of incremental capital cost as grant to cover part of the incremental operating cost)

A **grant being requested** from the OTF is the amount of US$ 2,692,953. This amount was calculated as follows : 10% was added to the net incremental capital cost. The final cost was multiplied by the percentage of Indonesian ownership (forty nine percent) and this figure was increased by a 15 percent contingency and 3% financial fee to yield the grant amount.

The 15 percent contingency is needed to ensure that the implementing enterprise still receives adequate compensation in cases in which the actual costs of items listed in this proposal exceed their estimated cost. As contingency funds would only be used for this purpose, including them in the total OTF grant would not necessarily increase the actual cost of the project.

Schedule

Task	1994						1995						1996					
Phase I																		
1. Model development																		
a. HFC-134a as refrigerant			x	x	x	x	x	x										
b. cyclopentane in PU foam				x	x	x	x	x	x									
2. Model testing					x	x	x	x	x	x	x	x						
3. Training		x	x	x	x	x												
Phase II																		
1. Procurement and equipment installation						x	x	x	x	x	x							
2. Commisioning and production line conversion										x	x							
3. Production start on :																		
a. HFC-134a												x	x	x	x			
b. cyclopentane													x	x				
Phase III																		
Complete elimination of ODS														x	x	x	x	

Note : x = two months of the year

REQUIRED REGULATORY ACTIONS

No regulatory actions, other than routine permitting, are required to implement this project. Under existing agreement with the World Bank, equipment and machinery imported as a part of this project will be exempt from import duty levied by the Indonesian Government.

PROJECT IMPACTS

Direct Project Impacts

This project will phase out 38.4 MT/year of CFC-12 and 134.3 MT/year of CFC-11 from P.T. Sharp Yasonta Indonesia (SYI) process after full-scale production of non-ODS refrigerators starts in 1997. In total approximately 172.7 ODP-weighted MT per year will be eliminated.

Indirect Project Impacts

This project will not impact product quality or reliability but will likely affect product price. The environment impacts associated with this project are expected to be negligible.

ANNEX A
CFCs USAGE AT P.T. SHARP YASONTA INDONESIA

Refrigerator is one of the main product line in P.T Sharp Yasonta Indonesia. CFC-11 is used as blowing agent in the polyurethane foam, while CFC-12 is used as refrigerant. Since 1992 SYI has been using the reduced CFC-11 reduced polyurethane foam formulation.

Year	Production (units)	CFC-11 usage (tons)		CFC-12 usage (tons)	
		Unconstrained	Proposed	Unconstrained	Proposed
1989	48,152	24.1		7.2	
1990	62,814	31.4		9.4	
1991	57,846	28.9		8.7	
1992	55,827	27.9	22.3	8.4	
1993	79,000	39.5	31.6	11.9	
Sub total	303,639	151.8	53.9	45.6	
1994	115,000	57.5	46.0	17.3	17.3
1995	146,000	80.3	56.2	23.4	23.4
Sub total	261,000	137.8	102.2	40.7	40.7
1996	175,000	96.3	0.0	28	0.0
1997	210,000	115.5	0.0	33.6	0.0
1998	252,000	151.2	0.0	42.8	0.0
1999	290,000	174.0	0.0	49.3	0.0
2000	334,000	217.1	0.0	56.8	0.0
2001	384,000	230.4	0.0	65.3	0.0
2002	442,000	265.2	0.0	75.1	0.0
2003	508,000	304.8	0.0	86.4	0.0
2004	584,000	350.4	0.0	99.3	0.0
2005	672,000	403.2	0.0	114.2	0.0
Total	*4,415,639*	*2,597.7*	*156.1*	*737.1*	*40.7*

Note :
- *Total from 1989 up to 1994, actual production*
- *Total from 1994 up to 2005, estimated by increase 20% per year*

ANNEX B

CAPITAL COSTS

(estimated costs in US dollar)

Phase I

A Investment Costs for Model Development						US$	556,900		
1.	Trial testing equipment				US$	30,000			
2.	Controlled ambient testing room				US$	150,000			
3.	Temperature recorders (at testing room)				US$	42,000			
4.	Temperature recorders (at home user)				US$	30,000			
5.	Surge proof (lighting test)				US$	5,000			
6.	Vibration tester				US$	0			
7.	Moisture detector				US$	46,800			
8.	Moisture and dust equipment				US$	12,000			
9.	Miscellaneous testing meter and facilities				US$	18,300			
10.	Compressor life tester				US$	0			
11.	CFC-12 recovery machine				US$	3,200			
12.	Leak detector				US$	3,000			
13.	Portable refrigerant charging equipment				US$	6,600			
14.	Technical assistance from Sharp Co. of Japan				US$	210,000			
	(redesign, production drawing, testing)								
	One-door model	3 US$	60,000						
	Two-door model	3 US$	90,000						
	Freezer model	2 US$	60,000						
B. Costs Associated with Testing of Refrigerators						US$	54,720		
1.	Prototype				US$	8,000			
	Number of models	8							
	Number of samples per model	4							
	Average material cost per sample	US$	250						
2.	Pre-pilot run				US$	46,720			
	Number of models	8							
	Number of samples per model	20							
	Average material cost per sample	US$	250						
	Average labor cost per sample	US$	42						
C Costs Associated with Information Gathering and Training						US$	61,000		
1.	Factory GM and advisor visit Japan (1 week)				US$	7,000			
2.	Visiting by non-CFC Sharp expert (1 week)				US$	6,000			
3.	The advisors visit Electrolux, Zanussi, etc (1 week)				US$	8,000			
4.	Send 2 engineers to Japan (1 month)				US$	20,000			
5.	Send 2 production technicians to Japan (1 month)				US$	20,000			
Total Investment Cost in Phase I								US$	672,62C

Phase II

D Investment Costs for Mass Production					**US$**	**3,561,450**
1. **Refrigeration System**			US$	149,000		
a. Refrigerant Charging Machine	US$	78,500				
b. Lubricant reclaimer (withdrawn by request)	US$	0				
c. Controlled ambient assembling line	US$	17,000				
d. HFC-134a leak detector (3 units)	US$	28,500				
e. Vacuum pump (withdrawn b (60 units)	US$	0				
f. Test line (clean room)	US$	15,000				
g. Quick joint vacuum coupler (200 sets)	US$	10,000				
h. QC sample testing room	US$	0				
(While SYI plans to buy two testing rooms funding is requested for one only A.2)						
2. **Foam Insulation System**			US$	3,412,450		
a. Cyclo-pentane foaming machine for cabinet liner	US$	607,250				
b. Cyclo-pentane foaming machine for door liner	US$	375,200				
c. Fire and explosion safety system	US$	290,000				
d. PU line conveyor	US$	1,120,000				
e. Cyclo-pentane underground storage tank	US$	150,000				
f. Oven	US$	780,000				
g. Boiler (1 ton)	US$	90,000				
h. Cyclo-pentane mixing station	US$	170,000				
Total Investment Cost in Phase II					**US$**	**3,561,450**
Total Investment Costs (Phase I and Phase II)					***US$***	***4,234,07(***

ANNEX C
INCREMENTAL OPERATING COSTS ***)

(estimated costs in US dollars)

Phase I

Costs for staff involved full-time in HFC-134a and Cyclo-pentane conversion project

1. Engineer		US$	21,600		
Number of engineers		1			
Salary per month	US$	900			
Number of months required		24			
2. Technician		US$	32,400		
Number of technicians		3			
Salary per month	US$	450			
Number of months required		24			
Total Cost				US$	54,000

Phase II

1. Estimated Production (units)

Type	Model	Production (units)					Total
			1996	1997	1998	1999	(units)
Refri-gerator	1 door	127 liters	18,000	22,000	26,000	30,000	96,000
		158 liters	90,000	108,000	130,000	150,000	478,000
		179 liters	27,500	33,000	40,000	48,000	148,500
	2 door	167 liters	3,500	4,000	5,000	5,000	17,500
		180 liters	8,000	9,500	11,500	13,000	42,000
		200 liters	10,000	12,000	14,000	16,000	52,000
Home freezer		115 liters	8,000	9,500	11,500	12,000	41,000
		170 liters	10,000	12,000	14,000	16,000	52,000
Total Projected Production			175,000	210,000	252,000	290,000	927,000

****) Incremental operating cost was calculated for reference only.*
SYI is requesting 10 % of incremental investment cost to cover for the incremental operating cost.

ANNEX C : INCREMENTAL OPERATING COSTS (... continue)

(estimated costs in US dollars)

2. Incremental Operating Cost per Unit

2.1. Refrigerant Circuit

Type	Model	Compressor		Refrigerant		Dryer		Piping		Total		Balance
		Now	New	Now	New	Now	New	Now	New	Now	New	(US$)
1 door	127 lit	29	34.8	0.3	1.2	0.6	0.8	1.5	1.7	31.4	38.5	7.05
	158 lit	30	36.0	0.3	1.2	0.6	0.8	1.7	1.9	32.6	39.9	7.27
	179 lit	30	36.0	0.3	1.2	0.6	0.8	1.8	2.0	32.7	40.0	7.28
2 door	167 lit	38	45.6	0.3	1.2	0.7	1.0	2.4	2.6	41.4	50.4	9.04
	180 lit	38	45.6	0.3	1.2	0.7	1.0	2.4	2.6	41.4	50.4	9.04
	200 lit	38	45.6	0.3	1.2	0.7	1.0	2.6	2.9	41.6	50.7	9.06
Freeze	115 lit	38	45.6	0.6	2.4	0.8	1.1	2.6	2.9	42.0	52.0	9.96
	170 lit	45	54.0	0.8	3.2	0.8	1.1	2.6	2.9	49.2	61.2	11.96

2.2. Insulation Foam

Type	Model	Now	New	Balance (US$)
1 door	127 lit	6.6	7.6	0.99
	158 lit	7.3	8.4	1.10
	179 lit	8.0	9.2	1.20
2 door	167 lit	9.3	10.7	1.39
	180 lit	9.8	11.3	1.47
	200 lit	11.3	13.0	1.70
Freeze	115 lit	9.0	10.4	1.35
	170 lit	10.2	11.7	1.53

Note :

1. *Price/kg of cyclo-pentane is less expensive than CFC-11, but consumption of PU material itself is bigger than CFC-11 PU due to higher density.*
2. *With the new layout and process, SYI predicts that standard time will be exceeded 3% than the old one, or it costs US$0.5/unit*

ANNEX C : INCREMENTAL OPERATING COSTS (... continue)

(estimated costs in US dollars)

2.3. Incremental Operating Cost per Unit

Type	Model	Ref. Circuit (HFC-134a)	Insulation (c-pentane)	Processing Cost	Total
1 door	127 lit	7.05	0.99	0.50	8.50
	158 lit	7.27	1.10	0.50	8.80
	179 lit	7.28	1.20	0.50	8.90
2 door	167 lit	9.04	1.39	0.50	10.70
	180 lit	9.04	1.47	0.50	10.90
	200 lit	9.06	1.70	0.50	11.10
Freeze	115 lit	9.96	1.35	0.50	11.80
	170 lit	11.96	1.53	0.50	13.90

2.4. Net Present Value of Incremental Operating Cost

Type	Model	1996	1997	1998	1999	
1 door	127 lit	153,000	187,000	221,000	255,000	
	158 lit	792,000	950,400	1,144,000	1,320,000	
	179 lit	244,750	293,700	356,000	427,200	
2 door	167 lit	37,450	42,800	53,500	53,500	
	180 lit	87,200	103,550	125,350	141,700	
	200 lit	111,000	133,200	155,400	177,600	
Freeze	115 lit	94,400	112,100	135,700	141,600	
	170 lit	139,000	166,800	194,600	222,400	
Total		1,658,800	1,989,550	2,385,550	2,739,000	
NPV factor		1	0.909	0.826	0.751	
Total NPV		1,658,800	1,808,700	1,971,419	2,057,811	7,496,729

2.5. Total Net Present Value Incremental Operating Cost

Phase I	54,000
Phase II	7,496,729
Total	7,550,729

NOTE : - This Incremental Operating Cost was calculated just for reference.
- SYI is requesting 10% of Incremental Investment cost to cover the incremental operating cost.

ANNEX D

UNIT ABATEMENT COST and PROPOSED OTF FINANCING

(estimated costs in US dollars)

1. ODS Saving

Phase-out : 1996-1999	CFC-11	CFC-12	Total
ODP	1.0	1.0	
Ave. annual ODS (kg)	134,300	38,400	172,700

2. Net Incremental Capital Costs

Overall project life, year	10	
Discount rate/year	10%	
Total incremental capital costs		4,234,070
Annualized incremental capital costs		689,075

3. Net Incremental Operating Costs

Overall project life, year	10	
Discount rate/year	10%	
Total incremental operating costs request		423,407
Annualized incremental operating costs		423,407

4. Unit abatement cost

	Cost/year	Unit cost/kg ODP saved
Annualized incremental capital costs	689,075	3.99
Annualized incremental operating costs	423,407	2.45
Total unit abatement cost		*6.44*

5. Proposed OTF Financing

Net incremental capital costs	4,234,070
Total incremental operating costs ***	423,407
Total incremental costs	4,657,477
Percentage of Indonesian ownership (49%) *	
New total cost	2,282,164
Contingency (15%)	342,325
Financial fee (3%)	68,465
Grant amount	**2,692,953**

* *During 1994, Indonesian ownership is 36.25%; but in 1995 it will be 49%*

*** *Total actual incremental operating cost over four years has been shown in ANNEX C. For the purpose of this project SYI is requesting 10% of incremental capital cost to cover for incremental operating cost.*

ANNEX E

ENVIRONMENTAL ASSESSMENT

This project will not result in any additional emissions, effluents, or wastes being produced at P.T. Sharp Yasonta Indonesia plant. It is the best judgment of the project proposal team that the project will meet all applicable Indonesian Government environmental, health, and safety regulations and will not trigger the need for a revised certificate of compliance.

ANNEX F

JUSTIFICATION ON CAPITAL COSTS

A. Purchase and set-up testing facilities in order to verify the performance reliability and durability of the refrigeration system. These will be done in factory premise and also monitoring at actual users' homes (field test).

1. Trial Testing Equipment

For the purpose of making trial sample refrigerators in order to verify the correct design of refrigeration system and proper selection of components (compressor, condenser, evaporator and capillary tube). This is initial testing requirement.

Detail :	Quantity	
1. Leak Detector	1 set	
2. Pirani Gauge	1 set	
3. Vacuum Pump	1 set	
4. HFC-134a refrigerant	1 can	
5. Dryer	20 pcs	
6. Seal Valve (PGV-630-2P)	20 pcs	
7. Seal Valve (PGV-400-2P)	20 pcs	
Total cost		US$ 30,000.

2. Controlled ambient testing Room.

Currently SYI has one testing room that can accommodate a maximum of 6 unit of refrigerators. However for this project, during the peak time of testing 20 unit of refrigerators need to be tested by each Quality Con trol and Engineering technician. These rooms are needed due to the fact that there are 8 models to convert in relatively short period of time. The newly developed non-CFC refrigerators must be tested continuously for a minimum of 2 years for durability test.

New Testing Rooms 2 units US$ 150,000./ea
(Including building modification).

(After receiving information from other manufacturer, and realizing the testing room will be used even after the model development stage. SYI only request grant for one testing room for US$ 150,000)

3. Temperature Recorder (at Testing Room)

Temperature recorder is used to record the temperature at the specific point in one unit refrigerator. During the peak period 20 sets of refrigerator will be tested together. Currently SYI has 6 temperature recorders and will purchase 12 more recorders . These recorders will be used in the random sampling and monitoring of refrigerator durability performance.

Hybrid Recorder (12 channels)	12 units	US$ 42,000.

4. Temperature Recorder (for monitoring at user's home - actual usage monitoring)

For the above test, SYI will select 100 customers for monitoring at various location in Indonesia. Only 20 out of total customers will be selected where each customer will have a recorder, to monitor the performance of the refrigerator. This recorder has only 6 recording points capability as the minimum testing requirement. The above test is to check the reliability and durability of the refrigerator. This procedure will be the standard cycle used in the development of future non-CFC refrigerator.

Hybrid Recorder (6 channels)	20 units	US$ 30,000.

5. Surge Proof (Lighting Test)

Surge proof is the testing done to ensure the newly developed refrigerator can withstand the high surge current and voltage (2.0 kA @ 20 second and 4.4 kA @ 50 second). The newly developed refrigerator is susceptible to moisture, because the oil in the compressor has a very high moisture absorption rate. This in turn can result in current leakage. Since the compressor motor is in the same casing as the compressor, the chances of current leakage is higher compare to the present type of compressor. In order to ensure the safety of the newly developed refrigerator high current and high voltage tests must be carried out. This equipment will be used to ensure product reliability and durability by random sampling.

Surge Proof	1 unit	US$ 5,000.

6. Vibration Test

Vibration test is carried out to ensure the endurance of the finished product at very severe vibration condition, especially considering the bumpy condition of road in many places in Indonesia. This testing will examine the fittings of the absorption capability of the product abet its components (e.g. to test the mounting of the newly developed compressor to the refrigerator). This equipment will be used to ensure product reliability and durability by random sampling.

Vibration Tester 1 unit
(SYI withdraw the request for funding for this equipment)

7. Moisture Detector

Moisture detector is used for monitoring the moisture content of the refrigerator's cooling system. The newly developed refrigerator is susceptible to moisture, this in turn can result in the cooling system being chocked and break down of the refrigerator. The equipment will be used for the random sampling for the above test during the mass production for product quality assurance.

Moisture Detector 1 set US$ 46,800.

8. Moisture and Dust Equipment

This is needed to analyze the oil and gas for any form of impurities and contamination. Due to susceptibility to moisture and the possibility of dirt contamination during handling, SYI need to analyze the oil continu ously using the random sampling method to ensure the purity of the oil. This sampling test will be carried out even after the mass production of non-CFC refrigerators.

Moisture and Dust Equipment 1 set US$ 12,000.

9. Miscellaneous Testing Meter and Facilities

Miscellaneous Testing Meter and Facilities is for the construction of the new testing room and the connection to the temperature recorder.

Miscellaneous Testing Meters and wiring, etc. US$ 18,300.

10. Compressor Life Tester

Compressor life test is carried out to monitor the performance of the compressor in the cooling system. This equipment will be used to ensure product reliability and durability by random sampling. (This is done because the newly developed compressors may or may-not withstand the huge voltage variation that is too common in the developing country.)

Compressor Life Tester 1 set US$ 0.
(Since this is what we should have for R-12 compressor, SYI withdraw the request for funding for compressor life tester)

11. Refrigerant Recovery Machine

Refrigerant recovery machine is used to take out refrigerant 134A from the refrigerator. This equipment will be used to evacuate and reuse the 134a in the product development.

134-a Recovery Machine 1 set US$ 3,200.

12. Leak Detector

This is a handheld Leak detector used to detect leakage of components and systems filled with refrigerants. This sampling test will be carried out even after the introduction of non-CFC refrigerators.

Leak Detector 1 set US$ 3,000.

13. Portable Refrigerant Charging Machine
It is used for charging of HFC-134a refrigerants into refrigeration system. For product development.

Portable Refrigerant Charging Machine 1 unit US$ 6,600.

14. Technical Assistance from Sharp Co. Japan

Since the HFC-134a and Cyclo-pentane technology is a new one, Sharp Co. Japan will provide the know-how of redesign, trial and test of refrigerator models, and provide training for engineering, production and service personnel. Sharp will also review our test results, retest if necessary and approve our design and production units.

The cost can be divided on :

	New Model Fee	Testing & Approval
One-door model (3 = 127,158,179)	US$ 30,000	US$ 30,000
Two-doors model (3 = 167,180,200)	45,000	45,000
Freezer model (2 = 115,170)	30,000	30,000
	US$105,000	US$105,000
Total cost		US$210,000.

B. Costs associated with testing of refrigerators.

As a standard procedure in design of a new model, SYI make between (3) to (5) units of prototype ("zero samples" in SYI term).These units are tested for around (1) month. If the results are satisfactory another (20) to (30) units of Pre-pilot run samples ("Engineering samples") are made by Engineering. These Engineering samples are further tested for two weeks. (Engineering samples are assemble with parts produce with production tooling.)

Production of a new models start with "trial production" of 100 units. Out of which (20) will be taken by QC for further testing (6 months to two years).

C. For Mass Production

1.1 Refrigerant Charging Machine

It is used in the production line for the charging of new refrigerants, HFC-134a, into refrigeration system. Because of unique swollen and leak characteristics to rubber which are much more severe than when used in conventional refrigerants, the present machine cannot be used. In the process of model by model conversion, we need both type of charger in the transitional period. Therefore retrofitting is not considered.

Refrigerant Charging Machine	1 unit	US$ 78,500.

1.2 Lubricant Reclaimer

Lubricant reclaimer is used to take oil from compressor whether the oil has been contaminated. The newly developed refrigerator is susceptible to moisture. In the production line 15 minutes is allowed between unplugging the compressors to final welding of the cooling system. In case of a line drop and repair in the production repair area moisture can enter into the system. This in turn can result in the cooling system being chocked and finally break down the refrigerant flow. This equipment will be used during the mass production in service area.
(The R-12 system is less sensitive to moisture and contaminant, so replacement of filter/dryer and longer vacuum time is sufficient in case of cooling system repair).

Lubricant Reclaimer	1 set	-.

(By request of the OORG reviewers SYI withdraw the request for funding for this equipment).

1.3 Controlled Ambient Assembling Line

It is used for controlling humidity level on compressor's assembly section. This unit will be used on the production line during the mass production.

Controlled Ambient Assembling Line	1 set	US$ 17,000.

1.4 HFC-134a Leak Detectors

It is used for checking leakage of HFC-134a in the refrigeration circuit. It includes leak standard calibrator for gas leak detector.

HFC-134a Leak Detectors (YHLD4a)	3 units	US$ 28,500.

(The actual quote from YAMAHA is 39,000 included accessories, SYI is only requesting grant for the main units)

1.5 Vacuum Pumps

Vacuum pump is used for removing air and moisture from the refrigeration system before it is filled with the refrigerants. Currently, SYI have 20 units of two-hoses vacuum pump and 50 units of one-hose vacuum pump. The new vacuum pumps are needed for higher vacuum level than the present R-12 system that is needed. This is due to the fact that 134a system is much more sensitive to moisture and contaminant.

SHARP STANDARD VACUUM LEVEL	R-12	134A
PUMP ONLY	<0.2 Torr	<0.05 Torr
Cooling system	<1.0 Torr	<0.50 Torr

(As requested by the OORG reviewers, SYI withdraw the request for funding of Vacuum Pumps).

1.6 Test Line (Clean Room)

It is used for checking whether there is a leakage in cooling system of refrigerator unit using leak detector. The air-room must be clean and not contaminated from other substance, in order to be able to detect propoerly.

Test Line (Clean Room)	1 unit	US$ 15,000.

1.7 Quick Joint Vacuum Couplers

This part is used for vacuum and refrigerant charging, one section on vacuum pump and other on refrigeration unit. SYI have 20 units of two-hoses vacuum pump and 50 units of one-hose vacuum pump, so that SYI needs 200 units of quick joint vacuum couplers.

Quick Joint Vacuum Coupler	200 units	US$ 10,000.

2. FOAM INSULATION SYSTEM

SHARP corporation of Japan from whom SYI is getting the technology, requested that SYI use PEG (Elastrogan, Japan) which is what they are using to make the technical support easier. However by request of OORG reviewer, SYI request funding at HENNECKE price level which is lower than PEG. **As stated in the main part of this proposal, retrofit of PU machines was considered but rejected due to safety consideration by SHARP corporation. (As far as we know, non of the Japanese company is planning for retrofit in Japan). In the time when SYI is gaining in market's share in a competitive market, retrofitting which is estimated to take one month or more will have disastrous effect on its market position.**

2.1 Cyclo-pentane Foaming Machines for Cabinet Liner

This system is used for injection of insulation system on cabinet liner. The present machine cannot be modified because we cannot stop current production and safety consideration .

Total cost	PEG (Elastrogan Japan)	US$ 893,000.
	Alternate HENNECKE	US$ 607,250.)
(For the purpose of funding SYI request		**US$ 607,250.**)

2.2 Cyclo-pentane Foaming Machine for Door Liner

This system is used for injection of insulation system on door liner. The present machine cannot be modified because we cannot stop current production and safety consideration.

Total cost	PEG (Elastrogan, Japan)	US$ 450,000.
	Alternate Hennecke	US$ 375,200.
(For the purpose of funding SYI request		**US$ 375,200.**)

2.3 Fire Safety System

This system is included gas leak detector, ventilator or extraction system, fire extinguisher and control panel. It will automatically give warning signal, increasing of ventilator's speed, and finally will stop the critical machines when detectors sense the specific concentration of Hydrocarbons.

Fire Safety System	1 unit	US$ 290,000.

2.4 Poly-Urethane Line Conveyor

This unit is used for bringing the cabinet and door liner to foaming machines during insulation injection. Because the vapor of cyclo-pentane is harmful for human health and the safety reason. In order to avoid possibility of spark's spring from the present conveyor, SYI needs the semi-automatic conveyor.

PU Line Conveyor	1 unit	US$ 1,120,000.

(The spec is from SHARP, actual quotation from NKC conveyor limited is 194 million Yen)

2.5 Cyclo-pentane Underground Storage

For safety, the cyclo-pentane must be stored in safe explosion proof tanks positioned in underground room made of 30 cm concrete and filled with sand. (SYI has not received detail spec from SHARP. However SHARP Appliance Thailand Limited is installing the same for 60 million Yen).

Cyclo-pentane underground storage	1 unit	US$ 150,000.

2.6 Oven

This oven is needed for the curing of the PU-foam in cabinets and doors. This oven is heated by the vapor generated by the boiler. This oven is located underground in PU conveyor line. (The PU conveyor will accept chemical charge at ground-level and dropped to underground line to pass through the oven for curing.)

Oven	1 unit	US$ 780,000.

2.7 Boiler

It is used for generating water vapor which will be used later by the oven for curing PU-foam in cabinets and doors.

Boiler	1 unit	US$ 90,000.

2.8 C-pentane mixing station

At the present, SYI buys the Polyol from ICI agent in Indonesia pre-mixed with CFC-11. For safety reason this can no longer be done when C-pentane is used in the future. Therefore SYI will need the new mixing station with all the exhaust ventilation and safety system.

Mixing station	1 unit	US$ 170,000.

Indonesia

REVIEW OF A HFC-134a CONVERSION PROJECT

Manufacture of HFC-134a Appliances at PT. Sharp Yasonta Indonesia (SYI)

Revised Project Proposal by The World Bank, October/November 1994

RTU-UNWB-LK-94550-lk

Scope

The project under review covers the conversion from CFC-12 to HFC-134a in circuits of refrigerators and the conversion from CFC-11 to cyclopentane. Only the HFC-134a part is reviewed here.

Technology

The HFC-134a technology selected is environmentally sound and safe. It is the most cost effective option that can be used at present. The proposal contains a phased approach for the introduction of HFC-134a, as given in OORG recommendations.

There is a technology assistance or licensing agreement for the conversion from CFC-12 to HFC-134a; costs associated with training should also be related to this technical assistance. If the technical issue only covers the development of new models (8 models as claimed) it can be considered as a separate issue. Compared to the production level (79,000 pieces), the investment costs for model development are rather high, the investment costs for mass production are adequate and reasonable.

As can be taken from the description, model development is assumed to be of high quality.

Environmental impact

The refrigerant proposed has a no ODP. Health and safety impacts are minimised.

Project costs

Most of the components are necessary for the conversion.

IA1. Controlled ambient test room and vibration tester

The testing room plus temperature recorders are rather expensive. However, since it will not only concern pilot tests, but both reliability testing and development purposes, costs are considered to be acceptable.

Moisture detection is in the order of USD 58,000; if this is needed under the specific testing and manufacturing circumstances, it is acceptable.

IB Costs associated with testing and IC Training

No comments, costs seem reasonable.

IID Investment costs

No comments.

Operating costs

Incremental operating costs observed in similar proposals are normally in the range of 2-7 USD. These are higher in this proposal, this is mainly due to the fact that the cost for the compressor increases by 20%. Costs need to be checked when mass operation has been started. No further comments.

Implementation timeframe

The implementation timeframe seems reasonable.

Recommendations

The HFC-134a conversion, as proposed in the project, can be recommended.

Kuijpers, LJM

Eindhoven, 3 November 1994

INDONESIA - SHARP YASONTA

TECHNOLOGY

This project involves the conversion of foam insulation for refrigerators / freezers from CFC 11 to cyclopentane. This technology is now proven and is in wide scale use.

It requires considerable investment in equipment for safe operation.

ENVIRONMENTAL ISSUES

Cyclopentane has a zero ODP and a very low GWP. It therefore represents a long term solution.

The main issue relates to safe operation with this very flammable blowing agent. Equipment changes and a safety packing involving training is included in the project. The provision of a signed undertaking relating to the adequacy of these safety measures should be provided by a competent technology partner (Sharp or PEG-Elastogran ?)

The enterprise should also ensure that it satisfies any relevant regulations concerning VOC emissions.

PROJECT COSTS

These have been reviewed in detail and are now acceptable. The equipment proposed is justified and the project allows for the funding of equipment at the lowest cost quotation received. Cost effectiveness is moderate.

IMPLEMENTATION TIMEFRAME

This is approved.

RECOMMENDATION

Approved subject to items on safety being addressed.

GMFJ/kd/4/11/94

The Montreal Protocol On
Substances That Deplete The Ozone Layer
Indonesia ODS Phaseout Project

Project Coversheet

COUNTRY :	Republic of Indonesia
PROJECT TITLE :	Elimination of CFC-11 in the manufacture of polyurethane foam sheet
SECTOR COVERED :	Foam-Blowing
ODS USE IN SECTOR :	Approximately 1,215 MT of CFC-11 and CFC-12 in all foam blowing application (1,215 ODP-weighted MT). Of this, about 200 MT of CFCs is consumed by small users in the non-insulating foam industry
PROJECT IMPACT :	Phaseout of 120 MT of CFC-11 (120 ODP-weighted MT) based on 1994 consumption
PROJECT DURATION :	1 year
PROJECT ECONOMIC LIFE :	10 years
TOTAL PROJECT COST :	ODS Reduction Investment Costs : US$ 341,075 Incremental Operating (cost) : US$ 1,175 Total Project Costs : US$ 342,250
COST - EFFECTIVENESS :	US$ 0.365 / ODP-weighted kg of ODS phased-out
PROPOSED OTF FINANCING : 1)	US$ 405,400 as a grant
IMPLEMENTING ENTERPRISES :	PT. MUSIMASSEJAHTERA ABADI
COORDINATING MINISTRY :	Indonesia Ministry of the Environment (LH)
IMPLEMENTING AGENCY :	The World Bank

PROJECT SUMMARY

This project will phaseout 120 MT of CFC-11 based on 1994 consumption in the production of flexible polyurethane foam (slabstock) at PT. Musimassejahtera Abadi by converting foam-blowing agent from CFC-11 to methylene chloride combined with increased water levels. To eliminate scorching during production of low density foam, the additional process heat that is generated will be removed by a vacuum cooling system. The enterprise will use support from an international foam specialist to convert the foam formulation and to train personnel in the safe handling of methylene chloride.

TECHNICAL ASSESSMENT

This project proposal is being submitted to the OORG reviewer for a final approval. It has addressed the reviewer concern about posible production enhancement and post implementation checks on safety.

1) Include 15 percent contingency and 3 percent financing agent fee.

PROJECT OBJECTIVE

The objective of this project is to phase out the use of CFCs in the manufacture of flexible polyurethane foam at PT. Musimassejahtera Abadi (hereafter referred to in this investment project proposal as "Musimas")

SECTOR BACKGROUND

The Indonesian non-insulating foam sector consists of approximately 36 large and medium-sized manufacturers, mainly concentrated on Java, and about two hundred small manufacturers, scattered over the other islands of the Republic. For the purpose of this project, large companies are defined as those using continuous foaming processes and having an ODS consumption of more than 50 MT. Among the large companies, 6 are producers of extruded polystyrene (EPS) and polyethylene (EPE) foam, 12 are flexible polyurethane foam (PUF) manufacturers (continuous process), and 2 are miscellaneous PUF manufacturers. In 1993, total consumption of CFC-11 and CFC-12 at these companies is estimated to be approximately 800 MT. Assuming that the smaller companies account for about 20 percent of the total consumption of ozone-depleting substances (ODSs), total ODS consumption in all non-insulating end uses is estimated to be close to 1,000 MT. Insulating end uses such as appliance insulation are expected to account for approximately 200 MT of CFCs. Overall consumption in the foam-blowing sector is therefore estimated to be approximately 1,200 ODP MT.

As articulated in the Republic of Indonesia's approved Country Program, the Indonesian State Ministry of Environment (LH) intends to achieve a phaseout of CFC use in the foam sector by 1997, provided that sufficient financing is available from the Multilateral Fund. Major challenges to this goal include the large amount of small users in the sector and the lack of availability of mature technologies for certain foam-blowing applications.

ENTERPRISE BACKGROUND

Musimas started its production at the plant in Jakarta in 1985. The company is a 100 percent Indonesian-owned enterprise. It employs about 200 people. Musimas's main products are slabstock polyurethane foams for shoe industries (80% of its products). The company has very strict quality standards because the products will be supplied to NIKE, Adidas, and REEBOK. Those are well-known brands of shoe producers.

The production volume for 1993 was about 2900 MT of slabstock foam. In 1994, however, it expects to increase production to approximately 3700 MT because starting in August 1994 it is using both a batch foam-making machine and a continuous production line. The continuous line usies a VERTIMAX low pressure machine. Musimas makes approximately 10 major types of foams with densities ranging from 7 to 32 kg/m3. Now the company uses only a batch foam-making machine.

In 1993, Musimas utilized about 96 MT of CFC-11 in the manufacture of slabstock flexible polyurethane foam. Because of the recert addition of a continuous line, in 1994, Musimas expects to utilize about 120 MT of CFC-11.

PROJECT DESCRIPTION

Methylene chloride has been identified as the preferred replacement for CFC-11 in slabstock foam-blowing operations. The technology is commercially avalaible. Its use will require some modifications to Musimas's low pressure VERTIMAX line in conjunction with safety related modifications in the production environment. Because the Vertimax machine has already been installed, all modifications are solely for non-ODS conversion and the project doesn't pay for production enhancement in anyway. Methylene chloride alone is not a sufficient replacement for CFC-11 currently used to produce the very low density foams that are common in Indonesia. Use of methylene chloride alone results in scorching that has an unacceptable adverse effect on the foam quality and, furthermore, constitutes a fire risk to workers. The conversion to methylene chloride will therefore be supplemented with a vacuum cooling system that will remove additional process heat that is generated. Vacuum cooling will also permit a reduction in the use of methylene chloride and a partial substitution to water-blown formulations.

Modifications needed to implement the use of methylene chloride and water as the blowing agents include:

* Increase in process ventilation for both maxfoam and batch foam-making lines
* Procurement of fire and safety equipment, and
* Installation of vacuum cooling equipment for both the VERTIMAX and batch equipment
* Reformulation

The project budget includes an international foams process expert to assist Musimas in making the necessary formulation adjustments and to provide the necessary safety training. The technology selected for this project is not licensed and the process specialist will ensure that effective transfer of the technology to Musimas occurs. Musimas will experience an increase in scrappage costs after converting to methylene chloride and increased water levels during the first two years. The estimated project budget accounts for the incremental costs associated with increased scrappage during this period.

JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY

There are numerous technologies to replace the use of CFCs in flexible foam. Methylene chloride constitutes the most economic solution. With the implementation of adequate safeguard methylene chloride can also result in an environmentally acceptable solution. Methylene chloride alone, however, is not appropriate for manufacturing foams with very low densities (i.e.,those foams with densities below about 20 kg/m^3). Based on trial runs using Mc to replace CFC-11 at PT. FOAMINDO (another Indonesian company making slabstock flexible polyurethane foam that has already had a project approved by the Multilateral Fund), the management of Musimas decided to opt for the use of methylene chloride along with increased water levels and vacuum cooling to replace its use of CFC-11.

The combination of these technologies will allow replacement of CFCs in a cost effective way, without unacceptable losses in performance and processing. A pre-condition is, however, a well planned reformulation program to implement adjustments in the amount of blowing agent as well as in the amount and type of catalysts.

Also, work place concentrations of methylene chloride have to be limited to acceptable industrial hygienic standards. Methylene chloride is a highly volatile chlorinated substance with a relatively low acute toxicity. The volatility can trigger high concentrations in the air. The substance is classified by both the U.S. Environmental Protection Agency (USEPA) and the International Agency for Research on Cancer (IARC) as a probable human carcinogen. The U.S. Occupational Safety and Health Administration has set an 8 hour time weighted averaga (TWA) level of 500 ppm for methylene chloride. In several other industrialized countries, the level is even stricter and is set at 50 ppm. Careful handling is therefore required to avoid over exposure. Examples of safety measures typically needed include: proper encapsulation of the production units that use methylene chloride, ventilation of production and storage areas, training of personnel in handling of the substance, and industrial hygienic monitoring.

PROJECT COST

As described below, and detailed in the relevant annexes, the total project cost (investment costs and recurring operating costs) over the first 4 years of the project is US$342,250. Funding from OTF is requested for US$405,400.

Investment Costs of US$341,075 are detailed in Annex A.

Net Incremental Operating Cost of US$1,175 are equal to the net present value of the first four years of incremental operating costs minus offsetting benefits. Operating costs reflect expected growth in demand for CFCs of 10 percent per year, a CFC-11 price of 4,200 rupiah per kilogram (US$2.10), a methylene chloride price of 1,500 rupiah per kilogram (US$0.75), and a reduction in product yield over the first four years of the project. Given a ten percent discount rate, the net present value of the incremental operating costs minus the offsetting savings over the first four years of the project results in a net costs of US$1,175. A more detailed breakdown of the operating costs and the assumptions used for each year of the project are provided in Annex B.

Other Costs. A 15% contingency or US$51,350 was also included to ensure adequate funding of project costs following project appraisal. An additional US$11,800 (3%) was added to the grant request to cover the fee for services of the financial institution (FI) that will appraise the projects and oversee procurement, disbursement and supervision.

Requested Funding. The proposed OTF grant for Musimas is US$405,400 and was calculated as follows: the present value of the net incremental operating cost over the first four years of the project were added to the total investment costs. The resulting total project cost was multiplied by the percentage of Indonesian ownership (100 percent). This figure was increased by a 15 percent contingency to yield the grant amount. Finallly, this figure was increased by 3 percent to account for the financial institution fee.

UNIT ABATEMENT COST

As derived in Annex C, the UAC calculated over the ten year life of the project is US$0.365 per ODP-weighted kg of CFC-11 phased out. This number is derived from the incremental annualized capital costs of US$55,510, the net annualized incremental operating cost, of US$222 and average annual savings of approximately 153 ODP-weighted MT of CFC-11 assuming a 10 percent annual growth rate in demand for CFC-11.

REQUIRED REGULATORY ACTIONS

At present, the Government of Indonesia levies varying duties on imported equipment. Because duties and taxes are considered transfer payments between organizations rather than true economic costs, the Multilateral Fund does not consider such costs as incremental. Hence, in order to reduce the total costs incurred by Musimas, it is recommended that the Indonesian government waive the import duty for all equipment supplied for this project.

RESULTS

This project will eliminate the use of at least 120 MT of CFC-11 based on consumption. Market and company growth indicates that this may increase by 10% annually in subsequent years.

IMPLEMENTATION

The LFI will insure that training for minimizing exposure to methylene has been provided prior to completion of implementation. Post implementation check on safety procedures will carried out through technical audit.

SCHEDULE

TASK	Q1	Q2	Q3	Q4
Finalize specifications, tenders, review bids, select equipment	xxx			
Site preparation		xxx		
Equipment arrival		x		
Installation of equipment			xx	
Start-up, trials, and training			xx	
Follow up visit from International Foams Expert				x

ANNEX A
Capital Costs (US$)

Process ventilation	
- for VERTIMAX machine (includes 40 ft piping at US$ 100/ft, 2 exhaust fans at US$ 5,000 each, encapsulation of cutting area at US$ 20,000, plus transportation, and installation at US$ 6,000)	40,000
- for curing area	10,000
- for batch foam-making machine	10,000
Fire safety	
- water lancing system	10,000
- sprinkler/piping/pumps	40,000
- pump shelter	2,000
- small portable dry chemical fire extinguishers	3,000
Occupational safety equipment	
- respirators (8)	1,200
- vapor tester for MeCl	2,000
Vacuum cooling	
- for VERTIMAX machine (includes for 40 m^2 construction at US$ 4,000/m^2, and installation at US$ 15,000)	175,000
- for the batch foam-making machine	11,000
International process specialist (2 trips) (includes training, trials, and set up)	20,000
Trial Material (15 minutes*10foam types*$450/min.)	67,500
75% cost recovery	(50,625)
TOTAL CAPITAL COSTS (US$)	341,075

ANNEX B
Net Incremental Operating Costs / Savings

COST ITEM	1995	1996	1997	1998
Baseline				
CFC-11 costs	277,200	304,920	335,412	368,953
Past Project				
Methylene chloride/water	84,150	92,565	101,822	112,004
Catalyst	4,875	5,363	5,899	6,489
Electricity for cooling	5,000	5,000	5,000	5,000
Reduced product yield	491,040	270,072	0	0
Net Incremental Operating Costs/(savings)	307,865	68,080	(222,692)	(245,461)
NPV @ 10 percent (4 years)	1,177			

Assumptions :
- 10 percent growth in demand, calculation based on 120 MT CFC use in 1994
- loss in product yield is 4% in first year. Assuming a typical learning curve, company halves this loss in each subsequent year. In first year loss is computed as follows : 3720 tons * $3.0/kg * 4 percent
- cost of amine catalyst US$3,75/kg, company uses 0.5 MT/year in first year of conversion
- cost of tin catalyst US$ 3 per year, company uses 1 MT/year in first year of conversion
- cost of CFC-11 is US$ 2.10/kg
- cost of increased MeCl formulation is US$ 0.75/kg
- substitution ratio of MeCl for CFC-11 is 85 %
- cost of non-CFC foam formulation is US$ 3.0/kg

ANNEX C
Unit Abatement Cost

A.	**ODS Savings**	
	ODP of CFC-11	1.0
	Annual growth in CFC-11 demand	10 percent
	Use of CFC-11 in 1994	120 MT
	Average Annual ODS Phased Out (1st 4 years)	153 MT
B.	**Incremental Capital Costs**	
	Economic life of project	10 years
	Total investment costs	US$ 341,075
	Annualized incremental capital costs	US$ 55,510
C.	**Net Annualized Incremental Operating Costs** (averaged over the first 4 years)	US$ 372
	UAC ($/kg ODP phase out)	0.365

PT MUSIMASSEJAHTERA ABADI

TECHNOLOGY

The choice of methylene chloride, together with increased CO_2 (water) of CFC 11 in flexible polyurethane slabstock is well proven - as is the use of vacuum cooling equipment. The main issue is the safe operation and this is addressed below. Methylene chloride is generally a cost-effective means of CFC replacement.

ENVIRONMENTAL IMPACT

Methylene chloride has very low ODP and GWP and is not a listed substance.

The safe use of methylene chloride is a critical factor and this issue is properly addressed in this project. The project caters for the necessary equipment including ventilation and fire safeguards, and for the training of personnel.

PROJECT COSTS

The capital costs are all for necessary equipment and other items such as training. The operating cost calculation results in a very small incremental cost.

The overall UAC is reasonably low, indicating a cost effective project.

IMPLEMENTATION TIMEFRAME

This is acceptable.

RECOMMENDATIONS

Approved as proposed.
Appropriate quotations should be included.

GMFJ/kd/11/10/94

The Montreal Protocol On Substances That Deplete The Ozone Layer
Indonesia ODS Phaseout Project

Project Coversheet

COUNTRY :	Republic of Indonesia	
PROJECT TITLE :	Elimination of CFC-11 in the manufacture of polyurethane foam sheet	
SECTOR COVERED :	Foam-Blowing	
ODS USE IN SECTOR :	Approximately 1,215 MT of CFC-11 and CFC-12 in all foam blowing application (1,215 ODP-weighted MT). Of this, about 200 MT of CFCs is consumed by small users in the non-insulating foam industry	
PROJECT IMPACT :	Phaseout of 90 MT of CFC-11 (90 ODP-weighted MT) based on 1994 consumption	
PROJECT DURATION :	1 year	
PROJECT ECONOMIC LIFE :	10 years	
TOTAL PROJECT COST :	ODS Reduction Investment Costs :	US$ 617,950
	Incremental Operating (saving) :	US$ (222,950)
	Total Project Costs :	US$ 395,000
COST - EFFECTIVENESS :	US$ 0.263/ ODP-weighted kg of ODS phased-out	
PROPOSED OTF FINANCING : 1)	US$ 468,000 as a grant	
IMPLEMENTING ENTERPRISES :	PT. POSITIVE FOAM INDUSTRY	
COORDINATING MINISTRY :	Indonesia Ministry of the Environment (LH)	
IMPLEMENTING AGENCY :	The World Bank	

PROJECT SUMMARY

This project will phaseout 90 MT of CFC-11 based on 1994 consumption in the production of flexible polyurethar foam (slabstock) at PT. Positive Foam Industry by converting foam-blowing agent from CFC-11 to methylene chloride combined with increased water levels. To eliminate scorching during production of low density foam, the additional process heat that is generated will be removed by a vacuum cooling system. The enterprise will use support from an international foam specialist to convert the foam formulation and to train personnel in the safe handling of methylene chloride.

TECHNICAL ASSESSMENT

This project proposal is being submitted to the OORG reviewer for a final approval. It has addressed the reviewer concern about posible production enhancement and post implementation checks on safety.

1) Include 15 percent contingency and 3 percent financing agent fee.

PROJECT PROPOSAL

The objective of this project is to phaseout the use of CFCs in the manufacture of flexible polyurethane foam (slabstock) at PT. Positive Foam Industry (hereafter referred to this investment project proposal as "Positive").

SECTOR BACKGROUND

The Indonesian non-insulating foam sector consists of approximately 36 large and medium-sized manufacturers, mainly concentrated on Java, and about two hundred small manufacturers, scattered over the other islands of the Republic. For the purpose of this project, large companies are defined as those using continuous foaming processes and having an ODS consumption of more than 50 MT. Among the large companies, 6 are producers of extruded polystyrene (EPS) and polyethylene (EPE) foam, 12 are flexible polyurethane foam (PUF) manufacturers (continuous process), and 2 are miscellaneous PUF manufacturers. In 1993, total consumption of CFC-11 and CFC-12 at these companies is estimated to be approximately 800 MT. Assuming that the smaller companies account for about 20 percent of the total consumption of ozone-depleting substances (ODS), total ODS consumption in all non-insulating end uses is estimated to be close to 1,000 MT. Insulating end uses such as appliance insulation are expected to account for approximately 200 MT of CFCs. Overall consumption in the foam-blowing sector is therefore estimated to be approximately 1,200 ODP MT.

As articulated in the Republic of Indonesia's approved Country Program, the Indonesian State Ministry of Environment (LH) intends to achieve a phaseout of CFC use in the foam sector by 1997, provided that sufficient financing is available from the Multilateral Fund. Major challenges to this goal include the large amount of small users in the sector and the lack of availability of mature technologies for certain foam-blowing applications.

ENTERPRISE BACKGROUND

Positive started its production at the plant in Sidoarjo, East Java, in 1990. This company is a 100 percent Indonesian-owned enterprise. It employs about 165 people. Positive's main products are for furniture, foam bed, sport shoes, car seat, packing, speaker, shoulder pad, mattress, and bedding products. Its products are not exported to other countries. In 1994, it expects to increase production to approximately 1500 MT of flexible slabstock polyurethane foam on two continuous production lines and a batch foam-production line. The continuous lines are run using Framal Machinery units. Positive makes approximately 20 major types of foams with densities ranging from 9 to 60 kg/m3. About eighty percent of Positive's foams are what it classifies as medium to high density (i.e., above 20 kg/m3).

In 1993, Positive utilized about 75 MT of CFC-11 in the manufacture of slabstock flexible polyurethane foam. In 1994 and 1995, Positive expects to utilize about 90 MT and 108 MT for each year.

PROJECT DESCRIPTION

Methylene chloride has been identified as the preferred replacement for CFC-11 in slabstock foam-blowing operations. The technology is commercially avalaible. Its use will require some modifications to Positive's low pressure FRAMAL **Machinery** lines in conjunction with safety related modifications in the production environment. Because the Framal machine has already been installed, all modifications are solely for non-ODS conversion and the project doesn't pay for production enhancement in anyway. Methylene chloride alone is not a sufficient replacement for CFC-11 currently used to produce the very low density foams that are common in Indonesia. Use of methylene chloride alone results in scorching that has an unacceptable adverse effect on the foam quality and, furthermore, constitutes a fire risk to workers. The conversion to methylene chloride will therefore be supplemented with two vacuum cooling systems that will remove additional process heat that is generated. Vacuum cooling will also permit a reduction in the use of methylene chloride and a partial substitution to water-blown formulations.

Modifications needed to implement the use of methylene chloride and water as the blowing agents include:

* Increase in process ventilation for both maxfoam and batch foam-making lines
* Procurement of fire and safety equipment, and
* Installation of vacuum cooling equipment for the FRAMAL Machinery units and batch equipment
* Reformulation

The project budget includes an international foams process expert to assist Positive in making the necessary formulation adjustments and to provide the necessary safety training. The technology selected for this project is not licensed and the process specialist will ensure that effective transfer of the technology to Positive occurs. Positive will experience an increase in scrappage costs after converting to methylene chloride and increased water levels during the first two years. The estimated project budget accounts for the incremental costs associated with increased scrappage during this period.

JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY

There are numerous technologies to replace the use of CFCs in flexible foam. Methylene chloride constitutes the most economic solution. With the implementation of adequate safeguard methylene chloride can also result in an environmentally acceptable solution. Methylene chloride alone, however, is not appropriate for manufacturing foams with very low densities (i.e.,those foams with densities below about 20 kg/m^3). Based on trial runs using Mc to replace CFC-11 at PT. FOAMINDO (another Indonesian company making slabstock flexible polyurethane foam that has already had a project approved by the Multilateral Fund), the management of Positive decided to opt for the use of methylene chloride along with increased water levels and vacuum cooling to replace its use of CFC-11.

The combination of these technologies will allow replacement of CFCs in a cost effective way, without unacceptable losses in performance and processing. A pre-condition is, however, a well planned reformulation program to implement adjustments in the amount of blowing agent as well as in the amount and type of catalysts.

Also, work place concentrations of methylene chloride have to be limited to acceptable industrial hygienic standards. Methylene chloride is a highly volatile chlorinated substance with a relatively low acute toxicity. The volatility can trigger high concentrations in the air. The substance is classified by both the U.S. Environmental Protection Agency (USEPA) and the International Agency for Research on Cancer (IARC) as a probable human carcinogen. The U.S. Occupational Safety and Health Administration has set an 8 hour time weighted average (TWA) level of 500 ppm for methylene chloride. In several other industrialized countries, the level is even stricter and is set at 50 ppm. Careful handling is therefore required to avoid over exposure. Examples of safety measures typically needed include: proper encapsulation of the production units that use methylene chloride, ventilation of production and storage areas, training of personnel in handling of the substance, and industrial hygienic monitoring.

PROJECT COST

As described below, and detailed in the relevant annexes, the total project cost (investment costs and recurring operating costs) over the first 4 years of the project is US$395,000. Funding from OTF is requested for US$468,000.

Investment Costs of US$617,950 are detailed in Annex A.

Net Incremental Operating Savings of US$222,950 are equal to the net present value of the first four years of incremental operating costs minus offsetting benefits. Operating costs reflect expected growth in demand for CFCs of 10 percent per year, a CFC-11 price of 4,200 rupiah per kilogram (US$2.10), a methylene chloride price of 1,500 rupiah per kilogram (US$0.75), and a reduction in prduct yield over the first four years of the project. Given a ten percent discount rate, the net present value of the incremental operating costs minus the offsetting savings over the first four years of the project results in a net savings of US$222,950. A more detailed breakdown of the operating costs and the assumptions used for each year of the project are provided in Annex B.

Other Costs. A 15% contingency or US$59,300 was also included to ensure adequate funding of project costs following project appraisal. An additional US$13,700 (3%) was added to the grant request to cover the fee for services of the financial institution (FI) that will appraise the projects and oversee procurement, disbursement and supervision.

Requested Funding. The proposed OTF grant for Positive is US$468,000 and was calculated as follows: the present value of the net incremental operating savings over the first four years of the project were subtracted from the total investment costs. The resulting total project cost was multiplied by the percentage of Indonesian ownership (100 percent). This figure was increased by a 15 percent contingency to yield the grant amount. Finallly, this figure was increased by 3 percent to account for the financial institution fee.

UNIT ABATEMENT COST

As derived in Annex C, the UAC calculated over the ten year life of the project is US$0.263 per ODP-weighted kg of CFC-11 phased out. This number is derived from the incremental annualized capital costs of US$100,600, the net annualized incremental operating savings of US$(70,300) and average annual savings of approximately 114 ODP-weighted MT of CFC-11 assuming a 10 percent annual growth rate in demand for CFC-11.

REQUIRED REGULATORY ACTIONS

At present, the Government of Indonesia levies varying duties on imported equipment. Because duties and taxes are considered transfer payments between organizations rather than true economic costs, the Multilateral Fund does not consider such costs as incremental. Hence, in order to reduce the total costs incurred by Positive, it is recommended that the Indonesian government waive the import duty for all equipment supplied for this project.

RESULTS

This project will eliminate the use of at least 90 MT of CFC-11 based on 1994 consumption. Market and company growth indicates that this may increase by 10% annually in subsequent years.

IMPLEMENTATION

The LFI will insure that training for minimizing exposure to methylene chloride has been provided prior to completion of implementation. Post-Implementation checks on safety procedure will the caried out through technical audits.

SCHEDULE

TASK	Q1	Q2	Q3	Q4
Finalize specifications, tenders, review bids, select equipment	xxx			
Site preparation		xxx		
Equipment arrival		x		
Installation of equipment			xx	
Start–up, trials, and training			xx	
Follow up visit from International Foams Expert				x

ANNEX A
Capital Costs (US$)

Process ventilation	
- for two Framal machines (includes 80 ft piping at US$ 100/ft, 4 exhaust fans at US$ 5,000 each, encapsulation of cutting area at US$ 40,000, plus transportation, and installation at US$ 12,000)	80,000
- for curing area	10,000
- for batch foam-making machine	10,000
Fire safety	
- water lancing system	10,000
- sprinkler/piping/pumps	80,000
- pump shelter	4,000
- small portable dry chemical fire extinguishers	6,000
Occupational safety equipment	
- respirators (8)	1,200
- vapor tester for MeCl	2,000
Vacuum cooling	
- for two Framal machines (includes for 80 m^2 construction at US$ 4,000/m^2, and installation at US$ 30,000)	350,000
- for the batch foam-making machine	11,000
International process specialist (2 trips) (includes training, trials, and set up)	20,000
Trial Material (15 minutes*20foam types*$450/min.)	135,000
75% cost recovery	(101,250)
TOTAL CAPITAL COSTS (US$)	617,950

ANNEX B
Net Incremental Operating Costs / Savings

COST ITEM	1995	1996	1997	1998
Baseline				
CFC-11 costs	207,900	228,690	251,559	276,715
Post Project				
Methylene chloride/water	63,113	69,424	76,366	84,003
Catalyst	4,875	5,363	5,899	6,489
Electricity for cooling	5,000	5,000	5,000	5,000
Reduced product yield	198,000	108,900	0	0
Net Incremental Operating Costs/(savings)	63,088	(40,003)	(164,294)	(181,223)
NPV @ 10 percent (4 years)	(222,923)			

Assumptions :

- 10 percent growth in demand, calculation based on 90 MT CFC use in 1994
- loss in product yield is 4% in first year. Assuming a typical learning curve, company halves this loss in each subsequent year. In first year loss is computed as follows : 1500 tons * $3.0/kg * 4 percent
- cost of amine catalyst US$3,75/kg, company uses 0.5 MT/year in first year of conversion
- cost of tin catalyst US$ 3 per year, company uses 1 MT/year in first year of conversion
- cost of CFC-11 is US$ 2.10/kg
- cost of increased MeCl formulation is US$ 0.75/kg
- substitution ratio of MeCl for CFC-11 is 85 %
- cost of non-CFC foam formulation is US$ 3.0/kg

ANNEX C
Unit Abatement Cost

A.	**ODS Savings**	
	ODP of CFC-11	1.0
	Annual growth in CFC-11 demand	10 percent
	Use of CFC-11 in 1994	90 MT
	Average Annual ODS Phased Out (1 st 4 years)	115 MT
B.	**Incremental Capital Costs**	
	Economic life of project	10 years
	Total investment costs	US$ 617,950
	Annualized incremental capital costs	US$ 100,600
C.	**Net Annualized Incremental Operating Savings** (averaged over the first 4 years)	US$ (70,400)
	UAC ($/kg ODP phase out)	**0.263**

PT POSITIVE FOAM INDUSTRY

TECHNOLOGY

The choice of methylene chloride, together with increased CO_2 (water) of CFC 11 in flexible polyurethane slabstock is well proven - as is the use of vacuum cooling equipment. The main issue is the safe operation and this is addressed below. Methylene chloride is generally a cost-effective means of CFC replacement.

ENVIRONMENTAL IMPACT

Methylene chloride has very low ODP and GWP and is not a listed substance.

The safe use of methylene chloride is a critical factor and this issue is properly addressed in this project. The project caters for the necessary equipment including ventilation and fire safeguards, and for the training of personnel.

PROJECT COSTS

The capital costs are all for necessary equipment and other items. There are operating cost savings over a four year period and the operating cost calculation is acceptable.

The overall UAC is low and indicate a cost effective project.

IMPLEMENTATION TIMEFRAME

The overall timeframe is acceptable.

RECOMMENDATION

Approved as proposed.
Appropriate quotations should be included.

GMFJ/kd/11/10/94

The Montreal Protocol On Substances That Deplete The Ozone Layer Indonesia ODS Phaseout Project

Project Coversheet

COUNTRY :	Republic of Indonesia
PROJECT TITLE :	Elimination of CFC-11 in the manufacture of polyurethane foam sheet
SECTOR COVERED :	Foam-Blowing
ODS USE IN SECTOR :	Approximately 1,215 MT of CFC-11 and CFC-12 in all foam blowing application (1,215 ODP-weighted MT). Of this, about 200 MT of CFCs is consumed by small users in the non-insulating foam industry
PROJECT IMPACT :	Phaseout of 200 MT of CFC-11 (200 ODP-weighted MT) based on 1994 consumption
PROJECT DURATION :	1 year
PROJECT ECONOMIC LIFE :	10 years
TOTAL PROJECT COST :	ODS Reduction Investment Costs : US$ 357,950 Incremental Operating (saving) : US$ (240,550) Total Project Costs : US$ 117,400
COST - EFFECTIVENESS :	US$ (0.069)/ ODP-weighted kg of ODS phased-out
PROPOSED OTF FINANCING : 1)	US$ 139,000 as a grant
IMPLEMENTING ENTERPRISES :	PT. MULTI KARYA MAKMUR
COORDINATING MINISTRY :	Indonesia Ministry of the Environment (LH)
IMPLEMENTING AGENCY :	The World Bank

PROJECT SUMMARY

This project will phaseout 200 MT of CFC-11 based on 1994 consumption in the production of flexible polyurethane foam (slabstock) at PT. Multi Karya Makmur by converting foam-blowing agent from CFC-11 to methylene chloride combined with increased water levels. To eliminate scorching during production of low density foam, the additional process heat that is generated will be removed by a vacuum cooling system. The enterprise will use support from an international foam specialist to convert the foam formulation and to train personnel in the safe handling of methylene chloride.

TECHNICAL ASSESSMENT

This project proposal is being submitted to the OORG reviewer for a final approval. It has addressed the reviewer concern about posible production enhancement and post implementation checks on safety.

1) Include 15 percent contingency and 3 percent financing agent fee.

PROJECT OBJECTIVE

The objective of this project is to phaseout the use of CFCs in the manufacture of flexible polyurethane foam (slabstock) at PT. Multi Karya Makmur (hereafter referred to in this investment project proposal as "Multi").

SECTOR BACKGROUND

The Indonesian non-insulating foam sector consists of approximately 36 large manufacturers, mainly concentrated on Java, and about two hundred small manufacturers, scattered over the other islands of the Republic. For the purpose of this project, large companies are defined as those using continuous foaming processes and having an ODS consumption of more than 50 MT. Among the large companies, 6 are producers of extruded polystyrene (EPS) and polyethylene (EPE) foam, 12 are flexible polyurethane foam (PUF) manufacturers (continuous process), and 2 are miscellaneous PUF manufacturers. In 1993, total consumption of CFC-11 and CFC-12 at these companies is estimated to be approximately 800 MT. Assuming that the smaller companies account for about 20 percent of the total consumption of ozone-depleting substances (ODS), total ODS consumption in all non-insulating end uses is estimated to be close to 1,000 MT. Insulating end uses such as appliance insulation are expected to account for approximately 200 MT of CFCs. Overall consumption in the foam-blowing sector is therefore estimated to be approximately 1,200 ODP MT.

As articulated in the Republic of Indonesia's approved Country Program, the Indonesian State Ministry of Environment (LH) intends to achieve a phaseout of CFC use in the foam sector by 1997, provided that sufficient financing is available from the Multilateral Fund. Major challenges to this goal include the large amount of small users in the sector and the lack of availability of mature technologies for certain foam-blowing applications.

ENTERPRISE BACKGROUND

PT. Multi Karya Makmur started its production at the plant in Jakarta in 1980. The company is a 100 percent Indonesian-owned enterprise with its head office and main factory located in Jakarta. It employs about 46 people. Multi's main products are mattresses, cushions for the furniture industry and paddings for the garment industry. Its products are not exported to other countries. The production volume for 1993 was about 1620 MT of slabstock foam. In 1994, however, it expects to increase production to approximately 4666 MT per year because starting in July 1994 it is using both a batch foam-making machine and a continuous production line at its two facilities in Jakarta. The continuous line us.es a VERTIMAX low pressure machine. Multi makes approximately 20 major types of foams with densities ranging from 10 to 33 kg/m3. About half of Multi's foams are what it classifies as medium to high density (i.e., above 20 kg/m3).

In 1993, Multi utilized about 84 MT of CFC-11 in the manufacture of slabstock flexible polyurethane foam. Because of the new addition of a continuous line, in 1994, Multi expects to utilize about 200 MT of CFC-11.

PROJECT DESCRIPTION

Methylene chloride has been identified as the preferred replacement for CFC-11 in slabstock foam-blowing operations. The technology is commercially avalaible. Its use will require some modifications to Multi's low pressure VERTIMAX line in conjunction with safety related modifications in the production environment. Because the Vertimax machine has already been installed, all modifications are solely for non-ODS conversion and the project doesn't pay for production enhancement in anyway. Methylene chloride alone is not a sufficient replacement for CFC-11 currently used to produce the very low density foams that are common in Indonesia. Use of methylene chloride alone results in scorching that has an unacceptable adverse effect on the foam quality and, furthermore, constitutes a fire risk to workers. The conversion to methylene chloride will therefore be supplemented with a vacuum cooling system that will remove additional process heat that is generated. Vacuum cooling will also permit a reduction in the use of methylene chloride and a partial substitution to water-blown formulations.

Modifications needed to implement the use of methylene chloride and water as the blowing agents include:

* Increase in process ventilation for both maxfoam and batch foam-making lines
* Procurement of fire and safety equipment, and
* Installation of vacuum cooling equipment for both the VERTIMAX and batch equipment
* Reformulation

The project budget includes an international foams process expert to assist Multi in making the necessary formulation adjustments and to provide the necessary safety training. The technology selected for this project is not licensed and the process specialist will ensure that effective transfer of the technology to Multi occurs. Multi will experience an increase in scrappage costs after converting to methylene chloride and increased water levels during the first two years. The estimated project budget accounts for the incremental costs associated with increased scrappage during this period.

JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY

There are numerous technologies to replace the use of CFCs in flexible foam. Methylene chloride (MeCl) constitutes the most economic solution. With the implementation of adequate safeguard methylene chloride can also result in an environmentally acceptable solution. Methylene chloride alone, however, is not appropriate for manufacturing foams with very low densities (i.e.,those foams with densities below about 20 kg/m^3). Based on trial runs using MeCl to replace CFC-11 at PT. FOAMINDO (another Indonesian company making slabstock flexible polyurethane foam that has already had a project approved by the Multilateral Fund), the management of Multi decided to opt for the use of methylene chloride along with increased water levels and vacuum cooling to replace its use of CFC-11.

The combination of these technologies will allow replacement of CFCs in a cost effective way, without unacceptable losses in performance and processing. A pre-condition is, however, a well planned reformulation program to implement adjustments in the amount of blowing agent as well as in the amount and type of catalysts.

Also, work place concentrations of methylene chloride have to be limited to acceptable industrial hygienic standards. Methylene chloride is a highly volatile chlorinated substance with a relatively low acute toxicity. The volatility can trigger high concentrations in the air. The substance is classified by both the U.S. Environmental Protection Agency (USEPA) and the International Agency for Research on Cancer (IARC) as a probable human carcinogen. The U.S. Occupational Safety and Health Administration has set an 8 hour time weighted averaga (TWA) level of 500 ppm for methylene chloride. In several other industrialized countries, the level is even stricter and is set at 50 ppm. Careful handling is therefore required to avoid over exposure. Examples of safety measures typically needed include: proper encapsulation of the production units that use methylene chloride, ventilation of production and storage areas, training of personnel in handling of the substance, and industrial hygienic monitoring.

PROJECT COST

As described below, and detailed in the relevant annexes, the total project cost (investment costs and recurring operating savings) over the first 4 years of the project is US$117,400. Funding from OTF is requested for US$139,400.

Investment Costs of US$357,950 are detailed in Annex A.

Net Incremental Operating Savings of US$240,550 are equal to the net present value of the first four years of incremental operating costs minus offsetting benefits. Operating costs reflect expected growth in demand for CFCs of 10 percent per year, a CFC-11 price of 4,200 rupiah per kilogram (US$2.10), a methylene chloride price of 1,500 rupiah per kilogram (US$0.75), and a reduction in product yield over the first four years of the project. Given a ten percent discount rate, the net present value of the incremental operating costs minus the offsetting savings over the first four years of the project results in a net savings of US$240,550. A more detailed breakdown of the operating costs and the assumptions used for each year of the project are provided in Annex B.

Other Costs. A 15% contingency or US$17,600 was also included to ensure adequate funding of project costs following project appraisal. An additional US$4,050 (3%) was added to the grant request to cover the fee for services of the financial institution (FI) that will appraise the projects and oversee procurement, disbursement and supervision.

Requested Funding. The proposed OTF grant for Multi is US$139,000 and was calculated as follows: the present value of the net incremental operating savings over the first four years of the project were subtracted from the total investment costs. The resulting total project cost was multiplied by the percentage of Indonesian ownership (100 percent). This figure was increased by a 15 percent contingency to yield the grant amount. Finallly, this figure was increased by 3 percent to account for the financial institution fee.

UNIT ABATEMENT COST

As derived in Annex C, the UAC calculated over the ten year life of the project is US$(0.069) per ODP-weighted kg of CFC-11 phased out. This number is derived from the incremental annualized capital costs of US$58,255, the net annualized incremental operating savings of US$93,550 and average annual savings of approximately 255 ODP-weighted MT of CFC-11 assuming a 10 percent annual growth rate in demand for CFC-11. The UAC is negative because the capital cost are amortized over project life but incremental benefits/saving are only considerd for four years only. Because the UAC is slightly negative, the project is therefore extremely cost effective and an excellent candidate for funding.

REQUIRED REGULATORY ACTIONS

At present, the Government of Indonesia levies varying duties on imported equipment. Because duties and taxes are considered transfer payments between organizations rather than true economic costs, the Multilateral Fund does not consider such costs as incremental. Hence, in order to reduce the total costs incurred by Multi, it is recommended that the Indonesian government waive the import duty for all equipment supplied for this project.

RESULTS

This project will eliminate the use of at least 200 MT of CFC-11 based on 1994 consumption. Market and company growth indicates that this may increase by 10% annually in subsequent years.

IMPLEMENTATION

The LFI will insure that training for minimizing exposure to methylene has been provided prior to completion of implementatio. Post implementation checks on safety procedures will be carried out through technical audit.

SCHEDULE

TASK	Q1	Q2	Q3	Q4
Finalize specifications, tenders, review bids, select equipment	xxx			
Site preparation		xxx		
Equipment arrival		x		
Installation of equipment			xx	
Start-up, trials, and training			xx	
Follow up visit from International Foams Expert				x

ANNEX A
Capital Costs (US$)

Process ventilation	
- for VERTIMAX machine (includes 40 ft piping at US$ 100/ft, 2 exhaust fans at US$ 5,000 each, encapsulation of cutting area at US$ 20,000, plus transportation, and installation at US$ 6,000)	40,000
- for curing area	10,000
- for batch foam-making machine	10,000
Fire safety	
- water lancing system	10,000
- sprinkler/piping/pumps	40,000
- pump shelter	2,000
- small portable dry chemical fire extinguishers	3,000
Occupational safety equipment	
- respirators (8)	1,200
- vapor tester for MeCl	2,000
Vacuum cooling	
- for VERTIMAX machine (includes for 40 m^2 construction at US$ 4,000/m^2, and installation at US$ 15,000)	175,000
- for the batch foam-making machine	11,000
International process specialist (2 trips) (includes training, trials, and set up)	20,000
Trial Material (15 minutes*20foam types*$450/min.)	135,000
75% cost recovery	(101,250)
TOTAL CAPITAL COSTS (US$)	357,950

ANNEX B
Net Incremental Operating Costs / Savings

COST ITEM	1995	1996	1997	1998
Baseline				
CFC-11 costs	462,000	508,200	559,020	614,922
Past Project				
Methylene chloride/water	140,250	154,275	169,703	186,673
Catalyst	4,875	5,363	5,899	6,489
Electricity for cooling	5,000	5,000	5,000	5,000
Reduced product yield	656,973	361,335	0	0
Net Incremental Operating Costs/(savings)	345,098	17,773	(378,419)	(416,760)
NPV @ 10 percent (4 years)	(240,551)			

Assumptions :

- 10 percent growth in demand, calculation based on 200 MT CFC use in 1994
- loss in product yield is 4% in first year. Assuming a typical learning curve, company halves this loss in each subsequent year. In first year loss is computed as follows : 4.666 tons * $3.2/kg * 4 percent
- cost of amine catalyst US$3,75/kg, company uses 0.5 MT/year in first year of conversion
- cost of tin catalyst US$ 3 per year, company uses 1 MT/year in first year of conversion
- cost of CFC-11 is US$ 2.10/kg
- cost of increased MeCl formulation is US$ 0.75/kg
- substitution ratio of MeCl for CFC-11 is 85 %
- cost of non-CFC foam formulation is US$ 3.2/kg

ANNEX C
Unit Abatement Cost

A.	**ODS Savings**	
	ODP of CFC-11	1.0
	Annual growth in CFC-11 demand	10 percent
	Use of CFC-11 in 1994	200 MT
	Average Annual ODS Phased Out (1st 4 years)	255 MT
B.	**Incremental Capital Costs**	
	Economic life of project	10 years
	Total investment costs	US$ 357,950
	Annualized incremental capital costs	US$ 58,255
C.	**Net Annualized Incremental Operating Savings** (averaged over the first 4 years)	US$ (93,550)
	UAC ($/kg ODP phase out)	**(0.069)**

PT MULTIKARYA MAKMUR

TECHNOLOGY

The choice of methylene chloride, together with increased CO_2 (water) of CFC 11 in flexible polyurethane slabstock is well proven - as is the use of vacuum cooling equipment. The main issue is the safe operation and this is addressed below. Methylene chloride is generally a cost-effective means of CFC replacement.

ENVIRONMENTAL IMPACT

Methylene chloride has very low ODP and GWP and is not a listed substance.

The safe use of methylene chloride is a critical factor and this issue is properly addressed in this project. The project caters for the necessary equipment including ventilation and fire safeguards, and for the training of personnel.

PROJECT COSTS

The capital costs are for necessary items. The operating cost calculation results in a small incremental operating cost.

The overall UAC is reasonably low which results in a cost effective project.

IMPLEMENTATION TIMEFRAME

The overall timeframe is reasonable. No starting date is provided.

RECOMMENDATIONS

Approved as proposed.
Appropriate quotations should be included.

GMFJ/kd/11/10/94

The Montreal Protocol On Substances That Deplete The Ozone Layer Indonesia ODS Phaseout Project

Project Cover Sheet

COUNTRY:	Republic of Indonesia
PROJECT TITLE:	Elimination of CFC-12 in the manufacture of extruded polyethylene and polystyrene foam sheet
SECTOR COVERED:	Foam-Blowing
ODS USE IN SECTOR:	Approximately 1.215 MT of CFC-11 and CFC-12 in all foam blowing application (1,215 ODP-weighted MT). Of this, about 200 MT of CFCs is consumed by small users in the non-insulating foam industry
PROJECT IMPACT:	Phaseout of 120 MT of CFC-12
PROJECT DURATION:	1 year
PROJECT ECONOMIC LIFE:	10 years
TOTAL PROJECT COST:	ODS Reduction Investment Costs: US$ 850,000 Incremental Operating (saving): US$ (379,300) Total Project Costs: US$ 470,700
COST - EFFECTIVENESS:	US$ 0.15 / ODP-weighted kg of ODS phased-out
PROPOSED OTF FINANCING: 1)	US$ 557,600 as a grant
IMPLEMENTING ENTERPRISES:	PT. INTER FOAMINDOSENTRA
COORDINATING MINISTRY:	Indonesia Ministry of the Environment (LH)
IMPLEMENTING AGENCY:	The World Bank

PROJECT SUMMARY

This project will phaseout 120 MT of CFC-12 consumption in the production of extruded polyurethane Polystyrene (EPS) and Polyethylene (EPE) foam sheet at PT. Inter Foamindosentra by converting the production line to the use of carbon dioxide supplemented with butane for both EPE and EPS. The enterprises expect to reach 100 % CO2 for EPS and 50 % CO2 for EPE after gaining more experience with CO2 technology.

TECHNICAL ASSESSMENT

This project proposal is being submitted to the OORG reviewer for a final review. The reviewer should note that the enterprise with no longer be able to convert directly to 100 % CO2 because the licensor of such technology is unwilling to make it available to Interfoamindosentra.

1) Include 15 percent contingency and 3 percent financing agent fee.

PROJECT OBJECTIVE

The objective of this project is to phase out the use of CFCs in the manufacture of extruded polyethylene/polystyrene foam sheet at PT. Inter Foamindosentra. (hereafter reffered to as "Interfoam").

SECTOR BACKGROUND

The Indonesian non-insulating foam sector consists of approximately 36 large and medium-sized manufacturers, mainly concentrated on Java, and about two hundred small manufacturers, scattered over the other islands of the Republic. For the purpose of this project, large companies are defined as those using continuous foaming processes and having an ODS consumption of more than 50 MT. Among the large companies, 6 are producers of extruded polystyrene (EPS) and polyethylene (EPE) foam, 12 are flexible polyurethane foam (PUF) manufacturers (continuous process), and 2 are miscellaneous PUF manufacturers. In 1993, total consumption of CFC-11 and CFC-12 at these companies is estimated to be approximately 800 MT. Assuming that the smaller companies account for about 20 percent of the total consumption of ozone-depleting substances (ODS), total ODS consumption in all non-insulating end uses is estimated to be close to 1,000 MT. Insulating end uses such as appliance insulation are expected to account for approximately 200 MT of CFCs. Overall consumption in the foam-blowing sector is therefore estimated to be approximately 1,200 ODP MT.

As articulated in the Republic of Indonesia's approved Country Program, the Indonesian State Ministry of Environment (LH) intends to achieve a phaseout of CFC use in the foam sector by 1997, provided that sufficient financing is available from the Multilateral Fund. Major challenges to this goal include the large amount of small users in the sector and the lack of availability of mature technologies for certain foam-blowing applications.

ENTERPRISE BACKGROUND

Inter Foamindosentra was first established its plant at Jakarta in 1986 under the name of PT. Super Fine Sari. In 1989, the company changed name to its present one. The company as a 100 percent of Indonesian-ownerskip. The Which employs about 102 people.

Interfoam's main products are EPE for furniture and elektronic packaging. and EPS for food and beverage packaging. The production volume in 1994 was 400 MT of EPS packaging and 160 MT of EPE packaging, and utilized about 110 MT of CFC-12. For the next of 1995 the company will utilize about 120 MT of CFC-12 to produce 450 MT of EPS packaging and 180 MT of EPE packaging.

PROJECT DESCRIPTION

Interfoam proposes to completely phase out its use of CFC-12 in EPS and EPE foam production and shift to CO_2 as its primary blowing agent. The company's preference is to find a supplier that will enable it to convert immediately to 100 percent CO_2 for all density and product types. Interfoam has learned, however, that the company which licenses the patented process using 100 percent CO_2 (in EPS) is neither willing nor able to provide its technology for this project or other in Indonesia. Interfoam has, therefore, identified other suppliers of CO_2 technology, Sencorp Technology that will enable it to make an immediate partial conversion. Only a certain product could achieve 100% CO_2 usage, though more often blended with other blowing agents such as HCFC-22, butane, etc, for a quality product concerns.

In EPS, based on Interfoam product range, only 10% of Interfoam product such as meat tray is possible to achieve 100% conversioan. Others like lunch box, egg box, laminated board and etc., will be very difficult to achieve 100% conversion. Sencorp could assist Interfoam to get immediate 25%- 35% for the first two years production period. 50% or more will be possible after the company gains some experience with the technology and receives further assistance from Sencorp or more advance technology. The estimated achievement for EPS as listed below:

- 1st year	25% CO2 / 75 % butane
- 2nd year	35% CO2 / 65 % butane
- 3rd year	40% CO2 / 60 % butane
- 4th year	50% CO2 / 50 % butane

In EPE, the CO_2 usage is still in development stages. The achievement of around 25% conversion to CO_2 is a maximum for the mean time. In Interfoam, the estimated achievement in the first year is 25% CO_2 blended with 75% butane, and the year after is the same as for EPS, depending on experiences gain and technology development.

Interfoam requires new equipment and modification to its process. Equipment needs include:

- New CO2 metering system
- New high pressure metering / injection system with explosion proof device for supplementary blowing agent
- Replacement of extrusion die with special cooling system provided for handling production different resins and blowing agents (EPS and EPE production required one set each)
- The safety equipments such as combustible gas detection system, anti-static blower, extinguihers are required to intall to prevent risks of fire
- New building construction to separete the extrusion line and storage room for safe use of butane as blowing agent for future consideration
- Rearrange all the electrical control cabinet, wirings, and provide adquate ventilation for the extrusion line as well as storage room
- Technical assistance to installation, commissioning, and test run the new equipments

- Consulting service for foam extrusion process using CO2/HCFC-22/butane required to achieve step by step follow up trials to enable in of CO2, R22, butane mixing technology.

JUSTIFICATION FOR SELECTION OF ALTERNATIVE TECHNOLOGY

Interfoam has selected carbon dioxide as its primary non-ODS technology. A complete shift from CFC-12 to CO_2 is possible but so far is still in development stages. Interfoam will supplement its use of CO_2 with butane both in EPS / EPS. Butane is chosen as supplemental blowing agent in EPE process after the company gains the experiences and technology development.

The CO_2 used in this process does not present a global warming risk (i.e., does not add net emissions to the atmosphere) because the gas is extracted from carbon dioxide present in normal air rather than produced as a by-product. In addition, carbon dioxide is:

- Non-toxic
- Non-flammable
- Low in cost
- Evironmentally friendly, and
- Soluble in polystyrene

The reason CO_2 cannot completely replace CFC-12 in the production of EPE foam sheet is because it is not very soluble in LDPE. HCFC-22 will therefore supplement CO_2 in this application for about four to six year. For future consideration Interfoam will try to use butane as supplemental blowing agent for CO2. Interfoam recognized that butane is an extremely flammable substance and has already received assistance to scope out safely precautions that will be required. Based on this assessment, full safety precautions will be taken by Interfoam to ensure that flammability and explosion risks will be minimized at its plant.

PROJECT COSTS

As described below and detailed in relevant annexes, the total project cost (investment costs and recurring operating costs) over the first 4 years of the project is US$ 470,700. Funding from OTF is requested for US$ 557,600.

Investment Costs of US$ 850,000 are detailed in Annex A.

Net Incremental Operating Cost (Savings) of US$ (379,300) reflect expected growth in demand for CFCs of 10 percent per year, a CFC-12 price of US$2.00 , and a price for food grade carbon dioxide of 1,000 rupiah (US$0,70). Given a ten percent discount rate, the net present value of yhe incremental operating costs minus the offsetting savings over the first four years of the project results in a net incremental operating costs (savings) of US$ (379,300). A more detailed breakdown of the operating costs and the assumptions used for each year of the project in Annex B.

Other Costs. A 15 % contingency of US$ 70,600 also included to ensure ade quate of funding of project cost following project appraisal. An additional US$ 16,200 (3%) was added to the grant request to cover the fee service of the financial institution (FI) that will appraisal the project and oversee procurement, disbursement, and supervision.

Requested Funding. The proposed OTF grant for Interfoam is US$ 557,600 and was calculated as follows: the present value of the net incremental operating cost over the first four years of the project were subtracted from the total investment cost. The resulting total project cost was multiplied by the percentage of Indonesia ownership. This figure was increased by a 15 % contingency to yield the grant amount. Finally, this figure was increased by 3 persent to account for the financial institution fee.

UNIT ABATEMENT COST

As derived in Annex C, the UAC calculated over the ten years life of the project is US$ 0.15 per ODP-Weighted kg of CFC-12 phased out. This number is derived from the incremental annualized capital cost of US$ 138,400, the net annualized incremental operating costs (savings) of US$ (119,700) and annual savings of approximately 120 ODP-Weighted MT of CFC-12. Because the UAC is so low, the project is therefore extremely cost effective and an excellent candidate for funding.

RESULTS

This project will eliminate the use of at least 120 MT of ODS in the first year of implementation. Because the demand for EPS and EPE are both increasing in Indonesia, it is quite likely that more ODS will be saved in future years of the project.

SCHEDULE

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Finalize specifications, tenders, review bids, select equipment	xxx			
Site preparation		xxx		
Equipment arrival		x		
Installation of equipment			xx	
Start-up, trials, and training			xx	
Follow up visit from International Foams Expert				x

ANNEX-A
Capital Cost (US$)

No.	Item	Unit		Price
1.	CO2 metering system	1 set	US$	120,000
2.	Butane/R22 Metering System	1 set	US$	110,000
3.	Safety Equipment Including : – Combustible gas detection system – Anti-Stat Blowers – Fire Extinguishers	1 set	US$	60,000
4.	Sencorp special Die Assembly for EPS Foam Extrusion	1 set	US$	160,000
5.	Sencorp special Die Assembly for EPE Foam Extrusion	1 set	US$	160,000
6.	Technical Assistance for installation & commissioning of the above item		US$	40,000
7.	Knowhow consulting fee for EPE & EPS Foam Extrusion-processing by using CO2 System, Butane & R22. including safety training, particularly with respect to the safe handling of flammable materials.		US$	100,000
8.	New Building construction for safe use of Butane as blowing agent for Foam Extrusion		US$	100,000
	TOTAL AMOUNT :		US$	850,000

Note: Spesification detailed in Attachment

ANNEX B
Incremental Cost

ITEM	1995	1996	1997	1998
BASELINE COSTS				
CFC-12	240,000	240,000	240,000	240,000
POST-PROJECT COSTS	216,405	128,100	54,975	54,975
NET INCREMENTAL OPERATING COSTS (SAVINGS)	(23,595)	(111,900)	(185,025)	(185,025)
NPV @ 10 PERCENT (4 YRS)	(379,316)			

Assumptions:
- No growth rate in product
- Cost of CFC-12 is US$2.00/kg
- price of food grade CO2 is US$0.70/kg
- price of butane is US$0.85/kg
- mass substitution ratio of butane for CFC-12 is approx. 1:1
- mass substitution ratio for CO2 for CFC-12 is approx 1:2
- consumption of CFC-12 does not increase above 120 MT
- EPS output is 65% of total and EPE is 35% of total
- For EPS conversion 35% substitution is achieved in the first year, 70% in the second year, and 100% thereafter
- For EPE conversion 35% substitution is achieved in the first year, 50% thereafter

ANNEX C
Unit Abatement Cost

A.	ODS Savings	
	Annual growth in CFC-12 demand	120 MT
	ODP of CFS-12	1.0
B.	Incremental Capital Cost	
	Economic Life of Project	10 years
	Total Investment Cost	US$ 850,000
	Annualized Incremental Capital Cost	US$ 138,400
C.	Net Average Annualized Incremental Operating Savings (over the first 4 years)	US$ (119,700)
	Unit Abatement Cost ($/kg ODP phaseout)	0.15

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RIA ENGINEERING

Plastic Machinery Specialist

Ref. RIA/941104.

October 20, 1994

Messrs **INTERFOAM INDOSENTRA PT.**
Jl. Muara Baru No. 12
JAKARTA UTARA

Revised on Oct 25, 94.

Attn. *Mr. Theodorus Tiara*
cc. MS. ANITA - SUDOFINDO (ext. 130).

*** QUOTATION ***

We are pleased to quote you as follows :

1.	CO2 Metering System (model CO2 : 10) *(detail specification as attached)*	1 set	**US$ 120,000.-**
2.	Butane/ R22 Injection High Pressure Metering system - Duplex Pump *(detail specification as attached)*	1 set	**US$ 110,000.-**
3.	Safety Equipments for Butane application *(detail specification as attached)*	1 set	**US$ 60,000.-**
	Including :		
	- Set of combustion gas detection system	1 set	**US$ 36,000.-**
	- Set of anti-stat blowers	1 set	**US$ 20,000.-**
	- Set of fire extinguishers	1 set	**US$ 4,000.-**
4.	Sencorp special Die Assembly for EPS Foam Extrusion (to allow CO2 / butane process)	1 set	**US$ 160,000.-**
	Sencorp special Die Assembly for EPE Foam Extrusion (to allow CO2 / butane process) *(detail specification as attached)*	1 set	**US$ 160,000.-**
5.	Technical Assistance for installation & commissioning of the above item 1 - 4		**US$ 40,000.-**

Including of :
- One mechanical engineer
- One electrical engineer
- One process engineer

Estimated 10 working days for each engineer at a rate of US$ 1,000 / day / enginer.

Estimated of US$ 10,000 for round trip ticket, accomodation, meal and other living expenses in Indonesia.

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RIA ENGINEERING

Plastic Machinery Specialist

Ref. RIA/941104. October 20, 1994

6. Knowhow consulting fee for EPS & EPE Foam Extrusion-processing by using CO2 / Butane & safety training.

Including of :

- Process consulting for CO2 /butane application on both PS and PE foam extrusion.
- Complete recommendations of the safe use of butane as a blowing agent for foam extrusion.
- Provide drawings and recommendation of new factory layout utilizing customer's existing foam processing equipment.
- On site inspection of customer's existing factory.
- Safety training
- Travelling and living expense for estimated 14 working days basis.

Package price of : **US$ 100,000.-**

7. New Building construction for safe use of Butane as blowing agent for Foam Extrusion **US$ 100,000.-**
   - Separate the storage and foam processing equipment into two isolated locations.
   - Separate the control panel, butane tanks from foam processing equipment.
   - Provide adequate ventilation for the building.
   - Disassemble and reinstall the machine into new position.
   - Remove all the underground wiring.
   - Provide safety devices such as leak detection alarms, water spraying etc. for fire concerns.

Estimated cost : **US$ 100,000.**

TOTAL AMOUNT : **US$ 850,000.-**

TERMS AND CONDITIONS :

DELIVERY	:	F.O.B. East Coast - U.S.A. Port.
SHIPMENT	:	Within 130 working days after order confirmation.
PAYMENT	:	50% down payment (by cash or bank draft) on order confirmation. 50% balance against confirmed irrevocable L/C drawn on a leading U.S. bank, payable upon presentation of shipping documents.
REMARKS	:	Freight, insurance, consular work, all applicable taxes, licences and duties are the responsibility of the buyer's.

Sincerely yours,

Khoo Kim Huat
G.S.M. Div. 1

l/kkh/al.

Ref.: ww/mark/spec/sencorp/co2-10 12/21

SENCORP MODEL - CO_2 - 10

CO2 PUMPING & METERING SYSTEM FOR CONTINUOUS OUTPUT OF 10 KG/HOUR.

1. System completely prepiped and wired. All tubing and fittings on high pressure side stainless steel rated at 10,000 PSI working pressure. All assembled on a free standing steel frame.

2. CO_2 Inlet temperature stabilization system - to ensure CO_2 vapor supplied (@ 150 - 300 PSI) remains a gas entering the pump.

3. Filtration and safety circuit - micron CO_2 filter, relief valve, pressure safety switch, manual shut off, pressure and temperatures gauges.

4. High pressure pumping system - air operated two stage gas booster with interstage cooling, air operated output control system for infinitely adjustable pressure up to maximum operating pressure. Secondary pressure control through pilot override circuit. High pressure inline filter provided at exit of pump.

5. Safety circuit and receiver - relief valve, rupture disc, automatic dump valve operation on loss of power or air.

   Tubular receiver for pulsation dampening and surge capacity.

6. Pressure and temperature stabilization system - system pressure regulator with rupture disc. Gas temperature regulating loop with pump, circulation heater, stainless steel heat exchanger, T/C feedback to P.I.D. controller and recorder.

7. Closed Loop Mass Flow Control System - digital mass flow meter for actual flow injected with remote electronic unit providing signals to P.I.D. controller, digital rate totalizer unit and and 4-pen recorder. Flow modulation function by pneumatic control valve and positioner, with E/P converter.

8. Injection pressure and safety circuit - relief valve, rupture disc and manual drain, pressure stabilizing regulator, gauge and injection pressure transmitter to recorder, manual shut off, check valve and mixing connection to existing blowing agent line.

Master Control Panel

1. Frame mounted Nema 12 panel wired to interconnecting terminal strip with :

   a. Mains isolator

   b. Hour meter

   c. Alarms : panel light, flashing beacon and audible alarm.
   - CO_2 low pressure supply
   - CO_2 low injection temperature
   - CO_2 low flow rate
   - High and low temperature for thermoregulating device.

   d. Safety interlock circuits for air and CO_2 pressure.

   e. CO_2 and heater circulation control switches.

   f. Power supply, contactors and fusing.

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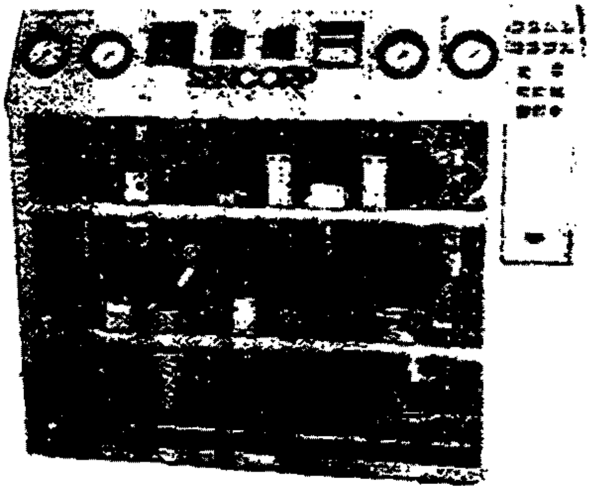

CO_2 Metering System

SENCORP's CO_2 metering system is a complete self-standing injection unit designed to operate in conjunction with other blowing agents or with CO_2 only.

The system for CO_2 metering has successfully overcome the difficulties associated with handling CO_2 providing complete reliability. Accurate control of temperature and pressure allows metering of CO_2 with minimal density variation.

Blends of CO_2 and other blowing agents for foam production offer several ADVANTAGES:

1. CO_2 is cheaper than most other blowing agents so considerable savings can be achieved.
2. Reduced amounts of many alternate blowing agents provide environmental benefits.
3. Energy savings of up to 3% are noted on the secondary extruder.
4. With some products, a higher quality can be produced due to the rapid migration of some CO_2 from the outer cells thereby preventing bubbling.
5. Production of fine cell foams can be enhanced.
6. Up to 25% of the prime blowing agent may be changed to CO_2 with no effect on the physical properties of the sheet.
7. Under certain conditions, up to 100% CO_2 can be used to eliminate undesirable blowing agents.

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Ref. : ww/mark/spec/sencorp/butane

BUTANE INJECTION SYSTEM PLUS SAFETY EQUIPMENT

HIGH PRESSURE METERING SYSTEM - DUPLEX PUMP *1 SET*

1. Completely prewired and prepiped free standing unit to precisely measure, blend and pump blowing agent into primary extruder.
2. All components are mounted on a rigid fabricated steel frame to resist vibration and shock.
3. Micro motion mass flow meter accurately measures blowing agent flow.
4. Integrally mounted duplex (piston type) blowing agent metering pump.
5. Digital Rate Totalizer indicates instantaneous and total BA usage.
6. Solid state controller indicates and controls blowing agent flow via an electronically controlled, pneumatically actuated flow control valve. Control signal is modified through an I to P converter.
7. Two-pen recorder is included to record blowing agent flow and injection pressure.
8. All electrical components are suitable for use in a Class I, Division II, Group D environment.
9. Piping between metering system and extruder is the responsibility of purchaser and must conform to local safety regulations.
10. Controls and indicators can be mounted locally, on unit frame or in master control panel.
11. All metering system piping, valves, fittings, etc. are rated for a working pressure to 10,000 Psi.

COMBUSTIBLE GAS DETECTION SYSTEM *1 SET*

To detect and warn of leakage of combustible blowing agents.

1. Eight (8) individual self-contained transmitters for installation in extrusion area to detect and alarm unsafe levels of combustible gas.
2. Operating range of 0 to 100% LFL (LEL).
3. Each transmitter feeds to an individual read out. Large vertical display indicated gas level in percentage. A warning is provided when gas level increases beyond calibrated setpoint. Further increase in gas level triggers alarm and begins automatic shut-down procedure of equipment. Outputs from module can be used to actuate plant safety equipment (sprinklers, CO_2 heads, etc.).
4. System is designed as INTRINSICALLY SAFE.
5. System includes "system failure" warning and can be easily calibrated in the field.

SET OF ANTI-STAT BLOWERS *1 SET*

Set of four blowers to treat sheet with ionized air to reduce static electrical charges.

SET OF FIRE EXTINGUISHERS *1 SET*

Set of four (4) portable fire extinguishers to place near extrusion line in case of blowing agent fire.

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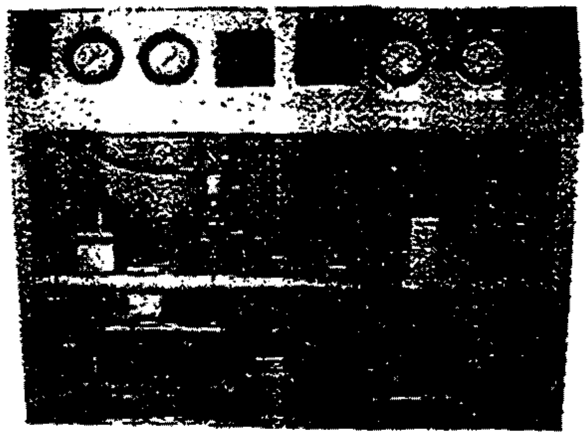
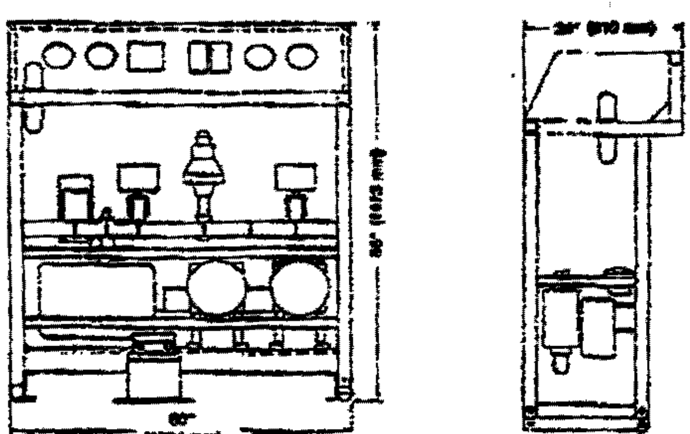


Foam Extrusion Line Blowing Agent Metering System

SENCORP's Foam Extrusion Line Gas Metering Systems are precision high-pressure systems designed to accurately supply a constant, measured flow of blowing agents to the foam extrusion process. The metering systems are available in single or dual gas models. The dual gas system combines CO_2 with the blowing agent used thereby reducing the amount of blowing agent required to achieve desired process results.

The metering system is completely self-contained and houses all instruments and equipment necessary to pump, mix and measure the gas/gases injected into the extrusion process. Digital display controllers are provided for all pressures, flows and temperatures along with a recording instrument for the permanent recording of all process variables.

The metering system has a control annunciator panel to visually and audibly indicate any process parameters that are out of their pre-selected operating ranges.



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SENCORP SPECIAL DIE ASSEMBLY FOR PS FOAM CONSISTING OF THE FOLLOWING :

Center fed single spider PS foam die including one (1) set of lips specially profiled for CO2 / butane blowing agent application.

- Die lip diameter of up to 150mm.
- Large body to allow heavy duty spider design.
- Streamlined flow cavities with internal fixed choke.
- Electrically heated spider.
- Oil passage way for inner lip (oil unit provided by customer).
- Die is internally heated with oil through spiraled center channel.
- Melt pressure and temperature taps.
- Adapter to extruder clamp included.
- Special high torque remote gap adjustment with digital readout can be adjusted while in operation.
- Outer lip is provided with 4-point concentricity adjustment.
- Die body is externally heated by cast aluminum jackets using heat transfer oil through integral INCOLOY tubes. Jackets are also provided with electric resistance heaters for quicker heat-up.
- Die internal surfaces are alloy plated and polished.
- PS Foam Die for :
  * Sheet width : 2 sheet x 650mm
    1 sheet x 1120mm
  * Thickness : 1.0mm - 6.0mm

Cooling and Sizing Mandrel

Diameter sized to produce web width of 650/1120mm..
Aluminum sizing mandrel, black Teflon coated with spiral tubes, for body zones and one nose zone. Coating for body section hard Teflon and for nose section nickel/Teflon plating.

Mandrel Support Cart - Double Slit Station

- Structural steel support cart to support cooling and sizing mandrel. Air and water lines fitted with non-flow restricting quick disconnects adjusting jacks for height alignment.
- Driven rotary slitting mechanism for slitting PS foam sheet is mounted on cart.
- Winch and cable installed on base for securing cart in position.
- Includes internal air ring. for bubble inflation and internal cooling.

Water Ring

Steel water cooling plates mounted on die face to reduce corrugation effect of foam sheet exiting the die.

SENCORP SPECIAL DIE ASSEMBLY FOR PE FOAM CONSISTING OF THE FOLLOWING :

Center fed single spider PE foam die including one (1) set of lips specially profiled for CO2 / butane blowing agent application.

- Die lip diameter of up to 150mm.
- Large body to allow heavy duty spider design.
- Streamlined flow cavities with internal fixed choke.
- Electrically heated spider.
- Oil passage way for inner lip (oil unit provided by customer).
- Die is internally heated with oil through spiraled center channel.
- Melt pressure and temperature taps.
- Adapter to extruder clamp included.
- Special high torque remote gap adjustment with digital readout can be adjusted while in operation.
- Outer lip is provided with 4-point concentricity adjustment.
- Die body is externally heated by cast aluminum jackets using heat transfer oil through integral INCOLOY tubes. Jackets are also provided with electric resistance heaters for quicker heat-up.
- Die internal surfaces are alloy plated and polished.
- PE Foam Die for :
  * Sheet width : 1200mm x 1mm
  * Thickness range : .5mm - 5.0mm

Cooling and Sizing Mandrel

Diameter sized to produce web width of 1200mm..
Aluminum sizing mandrel, black Teflon coated with spiral tubes, for body zones and one nose zone. Coating for body section hard Teflon and for nose section nickel/Teflon plating.

Mandrel Support Cart - Single Slit Station.

- Structural steel support cart to support cooling and sizing mandrel. Air and water lines fitted with non-flow restricting quick disconnects adjusting jacks for height alignment.
- Driven rotary slitting mechanism for slitting PE foam sheet is mounted on cart.
- Winch and cable installed on base for securing cart in position.
- Includes internal air ring, for bubble inflation and internal cooling.

Water Ring

Steel water cooling plates mounted on die face to reduce corrugation effect of foam sheet exiting the die.

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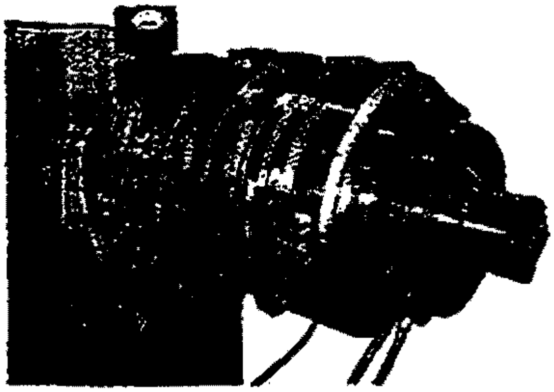

Foam Extrusion Die System

SENCORP, in addition to its standard line of center fed single and dual spider extrusion dies, offers special high performance dies with the following features:

1. Streamlined body flow cavities for uniform melt flow to the specially ground and polished die lips.
2. Patented outer T-lip with coarse-adjust concentricity by radial bolts and a fine-adjust concentricity system incorporating twelve independent sectors around the die lip capable of setting uniform gauge without mechanical distortion.
3. Specially designed inner lip with pressure balancing for stability and ease of gap adjustment. The gap adjustment is further enhanced by a reduction drive through the die allowing gap changes without disturbing the process.
4. Three zone temperature control by hot oil passed through cast aluminum jackets with their own independent internal heating elements. The inner and outer die lips have separate hot oil passageways for accurate temperature control close to the melt.
5. A range of specially contoured and baffled internal and external air rings complement SENCORP's high performance dies.

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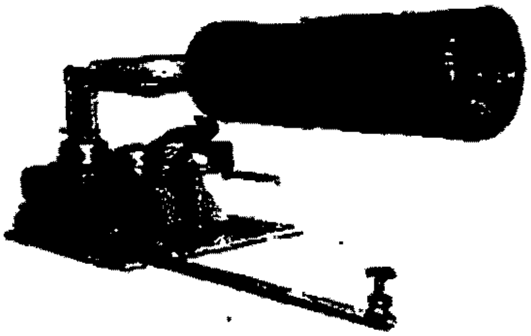


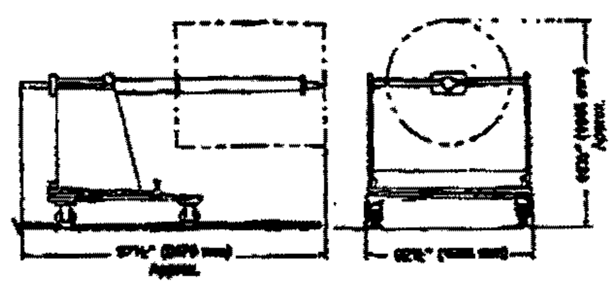
Foam Sheet Cooling and Sizing Mandrel

SENCORP's Cooling and Sizing Mandrels are available in diameters of up to 49 inches (1245 mm) and are designed to be provided in any length to suit specific process requirements. The mandrels are supplied mounted to a carrying cart which is designed for the rapid positioning of the mandrel as required by the extrusion process. All carts allow for the easy removal of the mandrel and the installation of another mandrel of different size. Mandrel change time is minimized by special construction and connections.

The standard mandrel is made from aluminum and has a black anodized outer surface. A separate cored nose piece is fitted which has a special low friction plating. Cast mandrels are also available with multiple sections for varying length and zone configuration.

The cart/mandrel assembly is completely self-contained with an internal air ring along with non-flow-restricting quick disconnect fittings for air and water. All mandrel support carts are provided with lifting points to allow for ease of handling. Slitting capability is provided for one or two sheet slitting.

Cooling of the mandrel is accomplished through independent two (2) zone control of the mandrel nose and body with precision control of the cooling water supplied by an optional dual loop heat exchanger.



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SENCORP's standard range of metering systems automatically process CO_2 as a gas during all stages of control from customer's storage system to the injection point of the extruder.

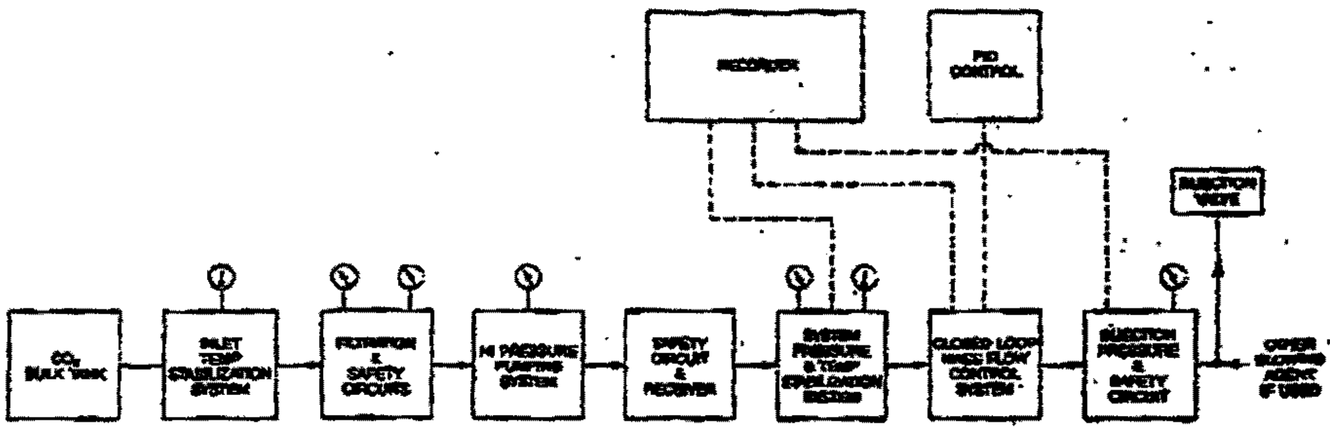
The metering system consists of several control loops:

1. Inlet temperature stabilizing control loop.
2. Pressure control loop plus secondary temperature stabilizing loop.
3. Automatic flow control loop.

All fittings and pipework are from stainless steel with high-pressure rating. All components used are of the highest quality to ensure compatibility with the medium being processed and conformity with the appropriate standards.

CO_2 has a "potency factor" of up to 3X that of many other prime blowing agents allowing 0.33 pounds of CO_2 to replace 1 pound of the other agent. In addition, due to its high vapor pressure, CO_2 is largely self nucleating. It produces an even cell size and at replacements up to 25% is difficult to detect. Replacement rates up to 100% have been used successfully on medium density products.

SENCORP has the technical and processing knowledge to assist customers to achieve the economical and physical benefits gained by using CO_2 as a foam blowing agent.



SENCORP SYSTEMS

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Belgium

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TELEFAX

To Mr. A. Karmali

cc : Mr. T. W. Waltz

26th October, 1994

PT Inter Foam Indosentra as requested.

Regards,

P/P G. M. F. Jeffs
GMFJ/kd

Note for T. Waltz - time 1 hour

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INDONESIA - PT INTER FOAMINDOSENTRA

TECHNOLOGY

The enterprise manufacturers extruded polystyrene and extruded polyethylene foam sheets for packaging. It proposes to move to CO_2 / butane blowing for polystyrene and a mix of 50% CO_2 and 50% butane over a period of two-four years.

All are proven technologies and are in use in many countries.

The use of these non-CFC blowing agents will require considerable plant modifications in the form of metering systems and extrusion dies plus safety equipment for the use of butane.

ENVIRONMENTAL ISSUES

CO_2 and butane have zero ODP and constitute long term solutions.

The primary use relates to the safe use of flammable butane. The enterprise makes provision for safety equipment and to contract in safety training.

PROJECT COSTS

The project is very cost effective (UAC $ 0.15/kg/yr) because operating cost savings partially offset the capital costs. However, these costs are justified. These include a technology / consulting fee which also covers safety training.

IMPLEMENTATION TIMEFRAME

This is acceptable.

RECOMMENDATION

Approved.

GMFI/kd/26/10/94