United Nations Environment Programme

Distr.
LIMITED

UNEP/OzL.Pro/ExCom/12/27
25 February 1994

ORIGINAL: ENGLISH

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

Twelfth Meeting
Montreal, 28-30 March 1994

PROJECT PROPOSALS: MALAYSIA

This document includes the following project proposals and the Fund Secretariat's Comments and Recommendations:

1. Phaseout of the use of CFCs in the manufacture of flexible polyurethane foam (slabstock) at small scale producers;

2. Elimination of the use of 111 TCA in the Automobile bumper cleaning processes at Perusahaan Otomobilo National Bhd (Proton);

3. Elimination of CFC-11 and CFC-12 in the manufacture of home refrigerators at SHARP-ROXY.

PROJECT EVALUATION SHEET

COUNTRY OR REGION:	Malaysia
PROJECT TITLE:	Phaseout of the use of CFCs in the manufacture of flexible polyurethane foam (slabstock) at small scale producers
BUDGET:	US $1,045,000
INCREMENTAL COSTS:	US $1,045,000
ODS PHASE-OUT:	80MT CFC-11 per year
COST EFFECTIVENESS:	US $13.1 per Kg. ODP saved
PROJECT DURATION:	Two years
IMPLEMENTING AGENCY:	UNDP
NATIONAL COORDINATING AGENCY :	Malaysia Department of Environment (DOE)
TECHNICAL REVIEW COMPLETED:	YES _X_ NO _

SECRETARIAT'S COMMENTS

1. This project is identical to one which was approved at the 11th Meeting of the Executive Committee (Technical Assistance Programme for small CFC Users in the Flexible Polyurethane Foam Sector - Indonesia) and one which is submitted by Philippines at the 12th Meeting.

2. This is a two-phase project to identify users and their assistance needs in the first phase and to convert about 30 small users from CFCs to methylene chloride in the second phase. This project includes three training workshops, funds for international and local foam expert technical assistance, and investment costs.

3. The primary cost is US $750,000 for safety measures associated with the use of methylene chloride for the 30 small user conversions anticipated for the second phase of the project.

4. The technical reviewer suggested that training materials of Indonesia could be used with some modifications to local circumstances, local experts could be used more frequently if international experts could thoroughly train them, and international experts' travel could be minimized if three countries' projects are well coordinated.

SECRETARIAT'S RECOMMENDATION

1. The Secretariat recommends final approval in the amount requested, i.e., US $1,045,000, and recommends that the technical reviewer's suggestions should be considered during the project implementation.

PROJECT EVALUATION SHEET

COUNTRY OR REGION:	Malaysia
PROJECT TITLE:	Elimination of the use of 111 TCA in the Automobile bumper cleaning processes at Perusahaan Otomobilo National Bhd (Proton)
BUDGET:	US $1,230,000 Incremental capital costs US $ 22,347 Incremental recurrent savings US $1,207,653 Total
INCREMENTAL COSTS:	US $700,439[1]
ODS PHASE-OUT:	195 MT of 111 TCA per year (1992)
COST EFFECTIVENESS:	US $3.6 per Kg. ODS saved
PROJECT DURATION:	21 months
IMPLEMENTING AGENCY:	UNDP
NATIONAL COORDINATING AGENCY :	Malaysia Department of Environment (DOE)
TECHNICAL REVIEW COMPLETED:	YES _X_ NO _

SECRETARIAT'S COMMENTS

1. Perusahaan Otomobilo National Bhd (Proton) is the national car manufacturer of Malaysia. 1.1.1 - Trichloroethane (111 TCA) is currently used to remove the mould release agent from the polypropylene bumpers. Under this project, the company will eliminate the use of 111 TCA by converting to an aqueous cleaning process.

2. Incremental capital costs costing US $1,230,000 cover a large aqueous cleaning system (22.1 meter length, 2.7 meter width), a water treatment/filtration system and training/trial run. Incremental recurrent savings are relatively small as savings without using 111 TCA are offset by the cost of alkaline cleaning agents and the costs of using large volumes of water.

3. The waste water effluent stream will be filtered and treated prior to discharge to drain, in compliance with the standards of the Department of Environment.

[1] This amount has been adjusted to reflect the local ownership of 58 per cent.

4. Implementation of the project will result in an estimated annual phase-out of 195 tonnes of 111 TCA.

5. The project was reviewed and supported by a technical reviewer.

SECRETARIAT'S RECOMMENDATION

1. The Project is recommended for final approval and for funding in the amount of US $700,439.

PROJECT EVALUATION SHEET

COUNTRY OR REGION:	Malaysia
PROJECT TITLE:	Elimination of CFC-11 and CFC-12 in the manufacture of home refrigerators at SHARP-ROXY
BUDGET:	US $1,025,000 incremental capital cost US $938,760 incremental operating cost
INCREMENTAL COSTS:	US $962,000[1]
ODS PHASE-OUT:	50MT of CFC-11 and 15MT of CFC-12 annually
COST EFFECTIVENESS:	US $14.8 per Kg. ODP saved
PROJECT DURATION:	Two years
IMPLEMENTING AGENCY:	UNDP
NATIONAL COORDINATING AGENCY :	Malaysia Department of Environment (DOE)
TECHNICAL REVIEW COMPLETED:	YES _X_ NO _

SECRETARIAT'S COMMENTS

1. This project covers the conversion of domestic refrigerator production at Sharp-Roxy in Malaysia to alternative technologies based on HFC-134a (refrigerant) and cyclopentane (blowing agent).

2. There was an overall lack of back-up information on incremental capital costs as well as operating costs. This finding was confirmed by UNDP's technical reviewer.

3. As this project proposal is a precedent in dealing with cyclopentane, the Secretariat requested, through UNDP, detailed information from Sharp-Roxy, regarding the eligibility of the activities and the purchase of new equipment. The possibility of modification of existing equipment should be assessed.

4. The technical reviewer discussed, with the company (Sharp-Roxy), the issues raised by the Secretariat. The company agreed to modify its request for incremental costs in the project.

[1] This amount has been adjusted to reflect the local ownership of 49 per cent.

5. The incremental operational costs per annum appear reasonable in comparison with Iran's project which was approved at the 11th Executive Committee meeting, and the projects for Egypt and Jordan which are being submitted at this meeting. The company (Sharp Roxy) agreed to modify its request for incremental operational costs from four years to 49 per cent of the annual recurrent costs.

SECRETARIAT'S RECOMMENDATION

1. The Fund Secretariat recommends approval of the project in the amount of US $962,000.

PROJECT COVER SHEET

COUNTRY:	**Malaysia**
PROJECT TITLE:	**Phaseout of the use of CFCs in the manufacture of flexible polyurethan foam (slabstock) at small scale producers.**
SECTOR COVERED:	**Foam**
ODS USE IN SECTOR:	**600MT CFCs in 1994**
PROJECT IMPACT:	**Residual phaseout of 80MT CFC-11 per year.**
PROJECT DURATION:	**One year**
PROJECT USEFUL LIFE:	**10 years**
TOTAL PROJECT COSTS:	**USD 1,045,000**
PROPOSED MLF GRANT:	**USD 1,045,000**
COST EFFECTIVENESS:	**USD2.14/Kg/y**
NATIONAL COORDINATING AGENCY:	**Malaysia Department of Environment (DOE)**
IMPLEMENTING AGENCY:	**UNDP**

PROJECT SUMMARY

This project will phase out consumption of CFC-11 at approximately 30 small companies in the flexible polyurethane foam sector in Malaysia. The first part of this two-part project will set up a technical assistance program to identify the specific types of assistance the small enterprise need and to develop a program to meet those needs. The program will be jointly coordinated by the Department of Environment Malaysia (DOE) and Westech Sdn Bhd. The second part will convert about 30 small users of CFCs to methylene chloride. The project will eliminate about 80MT of CFCs once all conversions have been implemented. In addition, the project will implement necessary measures to ensure the safe and effective use of methylene chloride at each of the participating enterprise.

TECHNICAL ASSESSMENT

The project has been reviewed and approved with modifications by Bert Veenendaal from UNDP's Technical Review Panel. His comments are attached.

PROJECT OF THE GOVERNMENT OF MALAYSIA
PHASEOUT OF THE USE OF CFCs IN THE MANUFACTURE OF FLEXIBLE POLYURETHANE FOAM (SLABSTOCK) AT SMALL SCALE PRODUCERS

1. PROJECT OBJECTIVE

The objective of this project is to establish a mechanism for providing assistance to small manufactures of flexible polyurethane foam and then to facilitate the phase out of CFC-11 at these companies.

2. SECTOR BACKGROUND

The CFC consumption in the foam sector in Malaysia is estimated to have reached at least 600t in 1991. CFC-11 and CFC-12 are the dominant substances in this sector, with much smaller usage of MCF, CFC-114 and CFC-115. The non-insulating foam industry consists of approximately 30 manufacturers with majority of them (25) in the small manufacturing process.

3. INTRODUCTION

The polyurethane slabstock industry has CFCs already substantially replaced by methylene chloride (MC). The motivation was not so much environmental awareness as economic necessity:

- The price of MC is lower than the price of CFC-11
- Replacement does not require a lot of capital investment and could even be done as complete "drop-in"
- Margins are very small in this extremely competitive industry and any opportunity to cut costs is used.

MC is a highly volatile chlorinated solvent with a relatively low acute toxicity. The volatility, however, can trigger high concentrations in the air. Careful handling is therefore required to avoid over exposure, i.e. proper encapsulation of production units utilizing MC, ventilation of production and storage areas, training of personnel in handling of the substance and industrial hygienic monitoring is required (a write-up on the properties of MC is provided in Annex-A)

The "drop-in" of MC has, however, in general taken place without any changes and may have created in many facilities hazardous workplace conditions. This has been specifically the case in smaller companies that lack awareness and funds to upgrade their equipment.

Not all CFC-11 is replaced as of yet:

- Some companies lack the knowledge to implement such a change;
- Others face opposition from workers who frequently experience the odor of MC as offensive;

- Some have certain technically challenging formulations that will not easily work with MC and have only partially replaced.

UNDP will provide technical assistance in

- Establish safe workplace conditions;
- Help enterprises in their efforts to completely phaseout CFCs;
- Would address the Government's concern that small scale and informal sector is not left behind and will be properly supported in their ODS phaseout efforts.

The government of Malaysia will implement an Act to disallow the use of CFC in flexible PUF application from the middle of 1994. Exception will be made for all companies that in join this program. These companies will be allowed to use CFCs until implementation of the program.

4. PROJECT DESCRIPTION

It is proposed to perform regional workshops on ODS phaseout technology, followed by plant visits. The visits have to culminate in specific proposals to implement and maintain safe CFC replacement. The individual costs will be low and it is proposed to grant lump sums for the upgrade of workplace conditions and chemicals for trials. Follow-up visit will be scheduled to check on actual compliance or to provide further assistance.

The project would start with identification of the organizations that should be involved and their function in the implementation. Specifically participation of Government and organizations representing the small scale and informal sector would be welcomed, even in a consultative more than an implementing role.

The project would then proceed with a survey to collect information on specific enterprise locations, equipment, MC/CFC usage and any specific circumstances. This survey would define location and to a certain extent contents of:

REGIONAL WORK SHOPS

Three regional work shops are targeted. The workshops and subsequent plant visits will inform the participants and host on ODS phaseout technologies, safety and assistance programs in the financial and technical area. Instructors will be "hands on" specialists with longstanding process experience. It is intended to verify the actual circumstances in the plants in the regional area immediately after the workshops, to propose concrete proposals for safe workshop conditions, any other action needed to allow the proper use of MC, including the supply of proposed formulation technology and to explain the actual funding. After contact by phone to assure that recommendations are followed up,

FOLLOW-UP VISITS

are scheduled. These are to confirm implementation or, in case that the recipient had to order chemicals for trials, to actually perform these trials. The follow-up visit will include an IH-survey to confirm safe workplace conditions.

5. PROJECT COSTS

The following is a summary of the expected related to the activities mentioned in the project description.

a)	Survey and workshop preparation		
	o survey		USD 10,000
	o syllabus and training material		USD 10,000
	o instruction of local support staff		USD 4,000
		Sub-total	USD 24,000
b)	Workshops and follow up		
	o conduction of workshops (3)		USD 90,000
	o plant visits from international experts		USD 35,000
	o plant visits and follow-up by local coordinator		USD 45,000
		Sub-total	USD 170,000
c)	Investments		
	o foam formulation trials 30 x USD5,000		USD 150,000
	o process upgrade (ventilation,curing) 30 x USD20,000		USD 600,000
	Contigency and rounding		USD 101,000
		Total	USD1,045,000

6. PROJECT IMPLEMENTATION

UNDP will implement the project with both international and local experts to assist in the workshops and in the subsequent plant visits.

7. PROJECT IMPACT

The project will have only a moderate direct impact on the use of CFCs (80MT). It will however, in addition, assure the safe implementation of previous phaseout efforts. It can be maintained that the CFC phaseout in the slabstock sector in Malaysia will be implemented in a remarkable cost effective manner.

8. ANNEXES - Annex A Technical Assessment.

JSL/BU/CC
94/02-05

TECHNICAL ASSESSMENT

PROJECT TITLE: Phaseout of the use of CFCs in the manufacture of flexible polyurethane foam (slabstock) at small scale producers

CATEGORY: Foamed Plastics-Flexible PUF Slabstock

RECOMMENDATION: The project is supported

INFORMATION: Somewhat brief on details

TECHNOLOGY: Methylene Chloride is an acceptable replacement technology. Some complementation may be needed with accellerated curing, but the project budget should be adequate for that purpose

REFERENCES: Similar projects in India, Indonesia and the Philippines

ENVIRONMENTAL: There is no limitation in Malaysia on the emission of MC. The substance has a short lifetime, no ODP, and a very small GWP

SAFETY: Issues on workplace safety are a priority and to be addressed in the implementation

COST EFFECTIVENESS: Good for the application on small enterprises (Philippines USD 3.49/kg/y compared with 2.14) although difficult to measure and to compare related to the element of technical assistance

OTHER ISSUES: Original comments pointed out that limitatin to MC alone before all plants are visited may introduce unnnecessary restrictions. the project is adjusted accordingly

REVIEWER: Bert Veenendaal
DATE: February 15, 1994

PROJECT COVER SHEET

COUNTRY:	Malaysia
PROJECT TITLE:	Elimination of the use of 111 TCA in the Automobile bumper cleaning processes at Perusahaan Otomobilo National Bhd (Proton)
SECTOR COVERED:	Solvent
ODS USE IN SECTOR:	1308 MT of CFC-113 in 1991 2829 MT of 111 TCA in 1991
PROJECT IMPACT:	195 MT of 111 TCA per year
PROJECT DURATION:	21 months
PROJECT USEFUL LIFE:	10 years
TOTAL PROJECT COSTS:	Total capital investment cost: USD 1,230,000 Total operating cost: USD (22,347) 1,207,653
PROPOSED MLF GRANT:	USD 700,439
COST EFFECTIVENESS:	USD 0.60
NATIONAL COORDINATING AGENCY:	Malaysia Department of Environment (DOE)
IMPLEMENTING AGENCY:	UNDP
APPRAISAL DATE:	8th November 1993

PROJECT SUMMARY

Perusahaan Otomobilo National Bhd (Proton) is the national car manufacturer in Malaysia. The cars are designed for both the local and export markets. 1,1,1-Trichloroethane (111 TCA) is currently used to remove the mould release agent from the polypropylene bumpers prior to painting and installation on the cars. Under this project the company will eliminate the use of 111 TCA by converting to an aqueous cleaning process using deionized (D.I.) water rinsing followed by a drying stage.

PROJECT OF THE GOVERNMENT OF MALAYSIA:
ELIMINATION OF THE USE OF 111 TCA IN THE BUMPER CLEANING PROCESS AT PERUSAHAAN OTOMOBIL NATIONAL BHD (PROTON)

1. PROJECT OBJECTIVE

The objective of this project is to phase out the use of 111 TCA in the bumper cleaning processes at Proton.

2. SECTOR BACKGROUND

The ODS consumption in the Malaysian solvent sector is estimated to have reached at least 1308 MT of CFC-113 and 28929 MT of 111 TCA in 1991. The industry is expected to grow rapidly in view of the foreign investment brought into Malaysia; in particular the electronics industry. ODS consumption in the solvent using industries is split between the electronics and metal cleaning processes. Electronic cleaning is concentrated on flux residue removal from printed wiring assemblies after soldering. Metal cleaning includes most gross cleaning of large or heavily soiled parts such as sheet metal cleaning, cleaning prior to painting or surface finishing and cleaning to remove machine oils from from manufactured parts. Precision cleaning of medical devices, guidance systems, miniature bearings, etc., represent a special sub-category of metal cleaning.

3. ENTERPRISE BACKGROUND

Perusahaan Otomobilo National Bhd (Proton) is the first and biggest automobile manufacturer in Malaysia. The company is a public listed company with a 58% share owned by Malaysia. The company consumed 195MT of 111 TCA per year in cleaning prior to painting of the approximately 240,000 polypropylene bumpers produced annually for the current 120,000 cars/year made by Proton. Production is anticipated to rise to 150,000 cars/year by 1995, which is equivalent to 300,000 bumpers/year. There is sufficient capacity available to meet this expected demand.

4. PROJECT DESCRIPTION

4.1 PROCESS SOILS

Soils to be removed are Silicone mould release agents and oils.

4.2 PRESENT PROCESS

Proton used about 195 MT of 111 TCA in the degreasing of polypropylene bumpers in 1992. A mould release agent is spray coated into the moulds during bumper production. This release agent must be completely removed from the surface of the bumpers after moulding before they are sent on to the painting department. At present, the cleaning is accomplished in a large, conveyorized vapor degreaser; 24 feet high x 24 feet long x 12 feet wide. The conveyor lowers the bumpers into the vapor zone twice during its passage through the unit. Drag-out of 111 TCA trapped in bumper crevices and moulding holes is a significant contributor to the high ODS consumption in this application.

4.3 PROPOSED ALTERNATIVE PROCESS

Under this project, the present conveyorized vapor degreaser will be replaced with a new aqueous/detergent cleaning process. It will be large in size (as is the current system) in order to handle the large pieces (bumper) being processed. Proton has worked closely with the equipment maker in Japan to design and prove out a new aqueous based cleaning process that will meet all of Proton's quality, cleanliness and production requirements.

The new cleaning process will be divided into three parts, which are:

i) Aqueous cleaning process (wash stage) - this is where the mould release agent is washed off the bumpers

ii) Rinse stage - the washed parts are rinsed first in ordinary water, then in deionized (D.I.) water and finally in an additive containing rinse to remove all residues from the wash stage. (The "additive", which is essentially a surfactant determined by the water quality, is designed to ensure spot free drying). The thoroughly clean, water-wet bumpers are then sent to the the drying stage.

iii) Drying stage - the bumpers are dried without water marks or water spots prior to painting.

Extra work space must be constructed to accommodate the new aqueous cleaning line in order not to interfere with production using the current 111 TCA cleaning process. Engineering work on electrical supply, piping

ventilation and plumbing will be required to ensure safe installation of the new equipment. Testing and process development will be done to ensure that satisfactory chemicals, concentrations, speed and temperature requirements are known and that an adequately performing system can be designed and operated. Trial runs will be made to ensure that processing speed and quality requirements can be met on the large, scaled up system. Training wil take place prior to startup to assure quality standards are not compromised as a result of the conversion to aqueous cleaning.

5. TECHNOLOGY

In the solvent sector, there are several options for replacement of 111 TCA for bumper cleaning:

- aqueous
- semi-aqueous
- chlorinated solvents
- hydrocarbon solvents

The company has reviewed all the alternatives and finally decided to replace the 111 TCA process with aqueous based cleaning because:

i) the aqueous system is used worldwide for bumper cleaning.

ii) it is the most economical and environmentally viable technology.

iii) the waste water can be discharged to Proton's existing water treatment plant.

iv) raw water is both plentiful (so there will not be a problem with continuous supply of water to the process) and inexpensive in Malaysia.

v) Proton's Multinational Partner has successful experience with an aqueous system.

6. PROJECT COSTS

6.1 TOTAL CAPITAL COSTS

The following summarizes the anticipated investment cost and related activities:

DESCRIPTION	SUB-TOTAL	TOTAL
· Aqueous Cleaning system with D.I. water and drier	$820,000	
· Water treatment/filtration system	65,000	
		$885,000
Facility Modification		
· Electrical wiring	35,000	
· Water piping	35,000	
· Engineering work	40,000	
· Ventilation improvement	25,000	
· Dismantle existing facilities	15,000	
. Scrap Value	(4000)	
		146,000
+		
· Equipment training		30,000
· Testing & process development		40,000
· Trial run		25,000
· Contingency & rounding		104,000
		$1,230,000

6.2 INCREMENTAL OPERATING COSTS

The incremental operating cost is expected to be nearly the same. Although there will be a substantial reduction in the consumption of the new aqueous cleaning chemical, the unit cost of the new chemical is much higher than 111 TCA. When the chemical costs are combined with the higher energy, water and maintenance costs of the new process, the company expects the total operating cost to be essentially the same as the present 111 TCA process.
The following table summarizes the incremental operating cost:

ITEM		PRESENT SYSTEM	PROPOSED AQUEOUS SYSTEM
1)	Solvent or chemical cost	$187,200 (195MT x $0.96)	$126,500 (2300liters x $5.50)
2)	Labour cost	$32,000	$32,000
3)	Energy cost	$4792.32 ($0.06 x 16 x 312 x16)	$10,782.72 ($0.06 x 8 x 312 x 36)
4)	Water consumption	0	$36,660 (250m3 x 312 x $0.47)
5)	Maintenance	$5000	$16,000
	Total	$228,992.32	$221,942.72

Difference $(7049.60)
NPV of 4 Year Difference= 0.7925 x (7049.60) x 4 = $(22,347.23)

6.3 UNIT ABATEMENT COST

- ODS reduction capital cost.....USD 1,230,000
- Annual incremental cost.....USD -0-
- Project useful life..... 10 years
- ODS reduction ..... 195,000 kg

Unit Abatement Cost [(a/c + b) /d] USD/kg/ 0.60

6.4 TOTAL PROJECT BUDGET

Capital cost:	USD 1,230,000
NPV of incremental operating cost:	USD (22,347.)
Total Cost:	USD 1,207,653
Malaysian ownership	x 0.58

Total Reimbursable Cost: USD 700,439

7 . FINANCING PLAN

The company requests reimbursement of the complete project costs, which are estimated to be: USD 700,439 (58% of the total local equity)

8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT
UNDP will oversee the completion of this project.

8.2 SCHEDULE
While some preliminary work has begun, the project will take place over the next 21 months, starting with approval of the project in Q2 of this year. 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 process and the water waste stream treatment prior to discharge to drain is in compliance with all DOE regulations.

TASK	TIME FOR COMPLETION 1994 Q2	Q3	Q4	1995 Q1	Q2	Q3	Q4
1. Preparation							
Board approval	x						
Visit vendor		x	x				
Order confirmation				x	x		
2. Installation							
Engineering work					x		
Arrival & installation						x	
Dismantle							x
3. Start-up, Training							
Machine start-up						x	
Training						x	

9. PROJECT IMPACT

This project will eliminate the use of at least 195 MT of 111 TCA during the first year of implementation.

10. ENVIRONMENTAL ASSESSMENT

Under this project, Proton will eliminate the use of 111 TCA by converting to an aqueous based cleaning system. The aqueous system is technologically and environmentally accepted world-wide. The waste water effluent stream will be filtered and treated prior to discharge to drain in compliance with the stringent standards of the DOE. Since the process is only used to remove the mould release agent from the polypropylene bumpers, it should not contain any heavy metals. Thus it is unlikely that this project will have an adverse environmental impact.

GLOBAL CENTRE FOR PROCESS CHANGE

P.O. Box 553
Montchanin, DE
19710-0553 USA

W. G. Kenyon
Tel: 302-652-5597
Fax: 302-652-5701

TO: C. J. NORRIS (UNDP) DATE: 10 FEB., 1994

SUBJECT: PROJECT TECHNICAL REVIEW

I have reviewed the Solvent Project, "Elimination of the Use of 111 TCA in the Automobile Bumper Cleaning Processes at Perusahaan Otomobilo National Bhd (Proton)" prepared by factory and UNDP personnel.

Technical Soundness

This project substitutes proven non-ODS aqueous technology from a developed nation partner for the current large conveyorized solvent cleaning line in use for bumper cleaning. Thus aqueous technology in a similar process is already in use and has demonstrated at least equivalent performance vs. the prior ODS cleaning process.

Safety

The use of aqueous technology for cleaning operations generally employs alkaline substances which may be corrosive. The use of properly designed equipment and established processes ensures that the appropriate safeguards are designed into the replacement technology. Thus chemical misting, heat and humidity emanating from the new process will be controlled via the improved ventilation which is part of the project. This is especially important given the very large scale of this cleaning equipment.

Environmental

The use of aqueous technology has the potential for the cleaning chemistries used to be carried into the waste stream along with the mould release agent. The project addresses the waste treatment issue by incorporating filtration and treatment capability in the capital investment portion. The filtration will remove any particulates while the water treatment will take care of dissolved contamination, including cleaning chemicals, in the water waste prior to release to the drain. Proper waste stream monitoring will enable factory personnel to adjust waste process settings for minimum environmental impact.

Cost Effectiveness

The project addresses cost effectiveness, using data that is felt to be quite accurate, since Proton's Multinational Partner is using a similar aqueous cleaning process for bumpers. While the capital replacement cost is high (reflecting the very large scale of the equipment), a significant operating cost reduction will be realized immediately. The calculated unit abatement costs for solvents at $0.59/kg, falls in the very acceptable range for non-ODS replacement technology.

Recommendations

It is recommended that this project be approved with the stipulation the factory carry out the waste stream monitoring needed to minimize environmental impact of the new process.

PROJECT COVER SHEET

COUNTRY:	**Malaysia**
PROJECT TITLE:	**Elimination of CFC-11 and CFC-12 in the manufacture of home refrigerators at SHARP-ROXY**
SECTORS COVERED:	**Foam and refrigeration**
ODS USE IN SECTOR:	**600MT in 1991 - foam 1500MT in 1991 - refrigerant**
PROJECT IMPACT:	**50MT of CFC-11 and 15MT of CFC-12 annually**
PROJECT DURATION:	**Two years**
TOTAL PROJECT COST:	**USD1,025,000 incremental capital cost USD938,760 incremental operating cost/year**
PROPOSED MLF GRANT:	**USD962,000 (reflecting 1 year incremental operating costs and 49% local equity)**
COST EFFECTIVENESS:	**USD17.00**
NATIONAL COORDINATING AGENCY:	**Malaysia Department of Environment (DOE)**
IMPLEMENTING AGENCY:	**UNDP**
APPRAISAL DATE:	**3 December 1993**

PROJECT SUMMARY

Sharp-Roxy Appliance Corp.(M) S/B(SRAC) is one of Malaysia domestic refrigerator manufacturers. Its products are mainly produced for the Malaysian market. CFC-11 is currently used in the production line as a blowing agent for the rigid foam panels and cabinets. CFC-12 is used as a refrigerant in the cooling system. This project will eliminate the use of CFC-11 and CFC-12 by converting to cyclopentane as a foam blowing agent and HFC-134a as a new refrigerant. This project covers the redesign of all refrigerator models and production conversion.

TECHNICAL ASSESSMENT

The project has been reviewed and conditionally approved by Bert Veenendaal from UNDP's Technical Review Panel. His comments are attached.

PROJECT OF THE GOVERNMENT OF MALAYSIA

Elimination of CFC-11 and CFC-12 in the manufacture of home refrigerators at Sharp-Roxy

1. Project objective

The objective of this project is to phase out the use of CFCs in the manufacture of domestic refrigerators at SRAC.

2. Sector background

The CFC consumption in the foam sector in Malaysia is estimated to have reached 600 MT in 1991. CFC-11 and CFC-12 are the dominant substances in this sector, with much smaller usage of MCF, CFC-114 and CFC-115.
The refrigerant is the biggest CFC consumption sector which constitutes 1500 MT in 1991. CFC-12 is the main substance used mainly in automobile and home appliances industry.

3. Enterprise Background

SRAC was established in 1985 as a production base for the Malaysian domestic market. At present, it produces a variety of products including colour TV's, VCRs, refrigerators, washers, gas cookers, vacuum cleaners and in the not too distant future, blenders and oven toasters. For the moment, only vacuum cleaners are exported overseas; this will however change, as more foreign manufacturers become aware of the competitive pricing and immaculate quality of our products. SRAC has a relatively large and dedicated work force of 530. It plans to shift to a bigger piece of land in a few years time to facilitate the expansion and development process.

The company is 49% Malaysian owned.

4. Project Description

SRAC utilizes annually 50 MT of CFC-11, as a blowing agent in the manufacture of rigid foam for the manufacture of home refrigerators and 15MT of CFC-12 for the refrigerant. Cyclopentane has been chosen the new blowing agent. New high pressure foaming equipment will be installed for this purpose. To optimize the insulation value, an improved mix of polyurethane will have to be applied, due to the reduced insulation value of cyclo-pentane. A mixing station is required as cyclo-pentane cannot be delivered premixed. A storage tank for cyclo-pentane is also. Extensive safety training for staff is foreseen. Gas detectors and a fire protection system will be installed in the foaming department. The exhaust and ventilation system will be upgraded in order to comply with safety requirements. All electrical systems and machinery that could come in contact with cyclopentane have to be explosion proof. It is necessary for SRAC engineers to be trained for the new technology using cyclopentane.

The currently used CFC-12 refrigerant system will be change to HFC-134a. New charging and vacuuming systems will be installed for this purpose. A new leak detector for HFC-134a will be required. To optimize the cooling system using the new alternative, a test room will be built to carry out research and cooling performance of each mode. The workers clothes, shoes and the floor need to be covered with an antistatic cover (paint).

5. Technology and selection

5.1 Overview and selection

There are several options to replace CFCs in the manufacture of home refrigerator. HFC-134a has been the most acceptable replacement for CFC-12 in the refrigerant industry. There is no other option commercially available. As for the blowing agent, there are several options such as

i) HCFC-141b
ii) HCFC-142b
iii) HCFC-142b & HCFC-22
iv) HFC-134a
v) Cyclopentane.

The company has decided to choose cyclopentane because it has no ODP and is considered a permanent solution in the manufacture of domestic refrigerators. The technology is increasingly applied and accepted.

5.2 Production process

The use of cyclopentane and HFC-134a will required substantial changes in the production process and storage facilities. Those include:

- Storage tank
  - Separate, explosion proof storage of the cyclopentane; pre-mixing station.

- Equipment
  - high pressure foaming machine, adapted for the use of flammable liquids
  - new charging and vacuum systems
  - new gas and leak detectors.

- Production
  - separated production area for the foam process
  - modification of foaming mould
  - explosion proof motors, switches and other electrical systems

- Auxiliary safety devices
  - upgraded ventilation system
  - fire protection system in foaming area
  - extra fire extinguishers

- Training
    - a test room for reliability tests
    - fire safety training
    - production training
    - training on handling of new equipment

The production area will be separated from other working area for protection against fire hazards. Production and maintenance personnel will be trained in the safe handling of hydrocarbons, in addition to production training. Start-up trials will be made to adjust for the different foaming volume and permeability.

6. Project cost

6.1 Incremental Capital cost

The following is a summary of the expected investment cost:

· Equipment		
· high pressure foaming machine	75,000[1]	
· leak detector for R-134a	20,000	
· charging and vacuuming machine	60,000	**155,000**
· Storage tank		
· cyclo-pentane tank	70,000	
· mixing stationary	80,000	
· chemical tanks	30,000	
· installation and testing	50,000	**230,000**
· Facility		
· charging board service for R-134a	35,000	
· antistatic floor and clothes	25,000	
· piping installation	20,000	
· production construction	20,000	
· equipment modification and engineering work	30,000	**130,000**
· Testing		
· test laboratory and prototype, foam test equipment, material compatibility and readability test	50,000	**50,000**
· Training		
· production and equipment training	30,000	
· safety training	15,000	**45,000**
· Fire safety system		
· exhaust and ventilation systems	25,000	
· fire protection and extinguishers	15,000	
· explosion proof motors and switches	40,000	
· sealing of electrical control cabinets	10,000	**90,000**
· Production trial run		**50,000**
· Process development, engineering and model redesign		**150,000**
· Pre/Post Audit		**20,000**
· Contingency and rounding		**105,000**
GRAND TOTAL		**US$1,025,000**

[1] Retrofit

6.2 Incremental operating cost

The estimation is based on a yearly production volume of 120,000 fridges. Four **main** models are to be considered here: SM 16,18,23 and 25.

Models	Production quantity/ year	Incremental cost/unit (US$)*	Incremental cost/year (US$)
16	48,000	7.70	369,600
18	48,000	7.73	371,040
23	18,000	8.16	146,880
25	6,000	8.54	51,240
GRAND TOTAL			938,760

* Please refer to the appendix for further explanations.

The cost of cyclo-pentane as a blowing agent is lower as compared to CFC-11, however, this will be offset by a higher insurance cost, maintenance and frequent training on safety and production.

6.3 Unit abatement cost

a) ODS reduction project cost	US$1,025,000
b) Incremental Recurrent Cost	US$ 938,760
c) Capital Recovery factor (10%; 10Y)	10 years
d) ODS reduction/year	65,000kg

Total Unit abatement cost [{a(c)+b}/d] **US$/kg/year 17.00**

7. Financing plan

The company request the reimbursement of 49% of the complete project cost--reflecting the local equity--estimated at

The complete project costs are defines as all incremental capital costs and one year incremental recurrent cost.

8. Project implementation

8.1 Management

UNDP will oversee the implementation of this project and provide technical assistance.

8.2 Schedule

Implementation schedule will start with MLF approval of the project and will end after monitoring has confirmed that at no place on the machine or in the working area is unsafe and all products requirement are met. For details it is referred to the attached schedule.

8.3 Procurement

UNDP will oversee the procurement.

9. Project Impact

This project will eliminate the use of at least 55MT of ODS in the first year of implementation. The project employs commercially and environmentally acceptable technology.

10. Annexes

Annex-A	Information on Capital Cost
Annex-B	Information on Recurrent Cost
Annex-C	Implementation Schedule
Annex-D	Technical Assessment

ANNEX-B

The table below shows the broken down incremental costs for each main part for a particular model.

N.B. Assumptions are made that compressors will go up by 20%, dryer by 15% and copper piping by 10%. All figures stated below are in ***US$***.

Model	***Compressor***	***Dryer***	***Piping***	***Misc.****	***Total***
16	6.84	0.09	0.23	0.54	***7.70***
18	6.84	0.09	0.26	0.54	***7.73***
23	7.20	0.09	0.30	0.57	***8.16***
25	7.53	0.09	0.35	0.57	***8.54***

* This also take into consideration of the price increase of the refrigerant(R-134a).

ANNEX-C

SRAC SCHEDULE FOR PHASE-OUT OF CFC (ESTIMATE)

13/01/1994

NO.	DESCRIPTION	1994 JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	1995 JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1	LAYOUT & LOCATION OF NEW MACHINE & TANKS	--->																							
2	FINALIZE DETAILS OF THE SYSTEM	--->																							
3	NEW PU SYSTEM & REFRIGERATOR SYSTEM TRAINING (OVERSEAS & LOCAL) - PRELIMINARY STAGE			--->																					
4	CONSTRUCTION OF UNDERGROUND STORAGE TANK FOR C-PENTANE			--->																					
5	SHIPMENT OF EQUIPMENT			--->																					
6	INSTALLATION & COMMISSIONING						--->																		
7	ENGINEERING TESTING & EVALUATION								--->																
8	QUALITY CONTROL TESTING & VERIFICATION										--->														
9	PRODUCTION PROCESS & SAFETY TRAINING											--->													
10	PREPARATION OF PIPELINE FOR SWITCH OVER																								
11	TRIAL RUN																								
12	MODIFICATION & IMPROVEMENT																								
13	MASS PRODUCTION																								

ED/01/94

PREPARED BY :

CONFIRMED BY :

ENGINEERING MANAGER

PRODUCTION MANAGER

QUALITY CONTROL MANAGER

APPROVED BY :

FACTORY MANAGER

TECHNICAL ASSESSMENT

PROJECT TITLE: Replacement of CFC-11 and CFC-12 in the manufacture of home refrigerators at **SHARP-ROXY**

CATEGORY: Foamed Plastics/Domestic refrigeration

RECOMMENDATION: The project is supported unde the condition that the individual elements of the capital and operating cost are documented in detail and that cost adjustments are made to the extend that the reviewers deem to be justified

INFORMATION: There is a lack of back-up information on the incremental capital cost as well as on the operating cost. It is felt that some of the cost assumptions are high. The company will have to document these and/or some extra sourcing may have to be done

TECHNOLOGY: Cyclopentane technology receives increasingly recognition as a viable and economic technology in the manufacture of domestic refrigerators, despite the fact that information on toxicity is lergely based on analogy.

The implementation of this technology should be accompanied by adequate safety measures that address the flammable character of this hydrocarbon.

REFERENCES: Similar projects in Egypt are submitted but not yet available for comparison

ENVIRONMENTAL: Cyclopentane is a VOC although currently not regulated in Malaysia. Also toxicity--although not expected to be an issue--is not fully explored. Regulatory and scientific developments to be monitored

SAFETY: Cyclopentane is flammable. Pre- and post-audits by the Implementing Agency on workplace safety are required. It is recommended to follow the **"UNDP Installation and Safety Manual for Cyclopentane"** (currently under development) during implementation

COST EFFECTIVENESS: The cost are too high. The company is provided with a list of items to be re-checked that may provide for lower cost.

OTHER ISSUES: To the knowledge of the reviewer, this is the first project in SE Asia utilizing Cyclopentane, which has to be imported. The technological and financial connection with Sharp-Japan--who will use cyclopentane itself for a part of its manufacturing program--will be a positive element in the implementation and makes this project an ideal demonstration project for the region. In addition, close monitoring and progress reporting of the Implementing Agency to the Fund is recommended to take full advantage of the "pilot" character of this project for SE Asia

REVIEWER: Bert Veenendaal/Foam

Stuart Kelly/Refrigerant

DATE: February 17, 1994