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

Thirteenth Meeting
Montreal, 25-27 July 1994

PROJECT PROPOSALS: THAILAND

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

- Elimination of the use of CFCs in the manufacture of commercial refrigerators at Sanden;
- Elimination of the use of CFCs in the manufacture of flexible polyurethane foam (slabstock) at Lucky Group.

PROJECT EVALUATION SHEET

COUNTRY OR REGION:	Thailand	
PROJECT TITLE:	Elimination of the Use of CFCs in the Manufacture of Commercial Refrigerators at Sanden	
BUDGET:	Incremental Capital Costs Incremental Operational Costs	US $630,000 US $253,100[1]
INCREMENTAL COSTS:	US $618,200[2]	
ODS PHASE-OUT:	13.25 MT of CFC-11 7.75 MT of CFC-12	
COST EFFECTIVENESS[3]:	US $29.44/Kg.ODP	
PROJECT DURATION:	One year	
IMPLEMENTING AGENCY:	UNDP	
NATIONAL COORDINATING AGENCY :	Department of Industrial Works, Ministry of Industry	
TECHNICAL REVIEW COMPLETED:	YES _X_ NO _	

SECRETARIAT'S COMMENTS

1. This project covers the conversion of commercial refrigerator production at Sonserm Sanden Refrigerator Co. Ltd. (SANDEN) in Thailand to HFC-134a (refrigerant) and cyclopentane (blowing agent). HFC-134a and cyclopentane are ultimate conversion solutions. The project will be implemented within one year.

2. Implementation of this project will result in an estimated annual phase out of 13.25 tons of CFC-11 and 7.75 tons of CFC-12.

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[1] Calculated for two years of operation.

[2] This amount has been adjusted to reflect the local ownership of 70 percent.

[3] Determined as the ratio of incremental costs to the estimated annual saving of ODP ($/$ODP_{kg}$).

3. The requested capital costs cover the replacement and modification of existing equipment to make it compatible with cyclopentane and HFC-134a. Cyclopentane is a highly flammable material. Project covers safety measures, training of personnel and technology transfer costs. The company has an excellent safety record and can cope with the safety aspects of cyclopentane. The company has done some preparatory work including visits to German factories that employ cyclopentane technology for foam production.

4. Incremental operational costs are calculated using current prices and requested for two years. The requested operational costs cover higher cost of HFC-134a compressor and refrigerant and higher cost of foam formulation.

5. The Secretariat submitted a policy paper showing the impact on the Fund of various operational cost durations in the domestic refrigeration sector. The operational cost durations will be an issue of discussion at the present meeting of the Executive Committee.

6. Sanden selected the HFC-134a compressor supplier which can currently provide compressors with the very moderate incremental cost of about US $2.50/unit.

7. The incremental operational costs will be incurred only after the full production of a new product has started, i.e. 12 months from the time funds are received. The incremental operational costs are likely to decrease within the coming year.

SECRETARIAT'S RECOMMENDATIONS

8. The Fund Secretariat recommends approval of the requested allocations at US $441,000.

9. The approval of incremental operational costs at US $177,200 is contingent on a decision from the Executive Committee regarding the duration of operational costs.

10. UNDP is requested to reassess the incremental operational costs on the basis of market prices prevailing at the time when actual costs are incurred and to report back to the Executive Committee. Agency overhead costs should be adjusted accordingly.

PROJECT EVALUATION SHEET

COUNTRY OR REGION:	Thailand	
PROJECT TITLE:	Elimination of the use of CFCs in the Manufacture of Flexible Polyurethane Foam (Slabstock) at Lucky Group	
PROJECT COST:	Incremental capital cost	US $605,000
INCREMENTAL COST:	US $605,000	
ODS PHASE-OUT:	187 tons of CFC-11 in 1993	
COST EFFECTIVENESS:	US $3.24 per kg ODP saved	
PROJECT DURATION:	One year	
IMPLEMENTING AGENCY:	UNDP	
NATIONAL COORDINATING AGENCY:	Department of Industrial Works, Ministry of Industry	
TECHNICAL REVIEW COMPLETED:	YES _X_ NO _	

SECRETARIAT'S COMMENTS

1. Lucky Group comprises four foam companies. The group manufacture flexible polyurethane foam for mattresses, cushions and other foam products for the bedding/furniture industry. Under this project, the group will eliminate CFC-11 by switching to the use of methylene chloride, coupled with a vacuum-cooling system (for light-weight foam production).

2. Capital costs consist of metering systems for methylene chloride, a vacuum-cooling system, an improved ventilation system, due to the toxicity of methylene chloride. Operational savings are not assumed due to the first two years' high scrappage ratio.

SECRETARIAT'S RECOMMENDATION

3. The Secretariat recommends final approval of the amount requested, i.e., US $605,000.

PROJECT COVER SHEET

COUNTRY:	THAILAND
PROJECT TITLE:	SANDEN elimination of the use of CFCs in the manufacture of commercial refrigerators
SECTOR COVERED:	Foams/refrigerants
ODS USE IN SECTOR: (1991)	1510t CFCs (=ODP) in Foams 980t CFCs (=ODP) in Refrigerants
PROJECT IMPACT:	13.25 t/y CFC-11; 7.75 t/y CFC-12 based on Apr-93 --> Mar-94 figures
PROJECT DURATION:	One year
PROJECT ECONOMIC LIFE:	10 Years
TOTAL PROJECT COSTS:	USD 630,000 Incremental Capital Cost USD 253,100 Incremental Recurrent Cost
PROPOSED MLF GRANT:	USD 618,200 (reflecting 70% local ownership)
COST EFFECTIVENESS:	USD 11.83/kg/y (unit abatement cost)
NATIONAL COORDINATING BODY	Ministry of Environment, Department of Industrial Works (DIW)
IMPLEMENTING AGENCY:	UNDP
APPRAISAL DATE:	April 20/June 8,1994

PROJECT SUMMARY

Under this project Songserm Sanden Refrigerator Co. Ltd. ("SANDEN") will eliminate the use of CFCs in the manufacture of commercial refrigerators through the introduction of a combination of water/cyclopentane for the insulation foam and HFC-134a for the refrigerant. The project includes equipment modifications, production trials, testing and training.

Prepared by: Tommy Lauridsen
Reviewed by: Bert Veenendaal UNDP Sector Expert (Foams)

PROJECT OF THE GOVERNMENT OF THE THAILAND

SANDEN ELIMINATION OF THE USE OF CFCs IN THE MANUFACTURE OF COMMERCIAL REFRIGERATORS

1. PROJECT OBJECTIVE

The objective of this project is to phaseout the use of CFCs in the manufacture of commercial refrigerators at Songserm Sanden refrigerator Co. Ltd.

2. SECTOR BACKGROUND

ODS are used as blowing agents in the production of five types of foams in Thailand--appliance insulation, flexible foams, rigid construction insulating foams, polystyrene packaging and miscellaneous applications. Producers of foam products in Thailand used almost 1,600t of ODS in 1991, primarily CFC-11 and to a lesser extend CFC-12.

The refrigeration sector consumed in the same period almost 1,000t CFCs, predominantly CFC-12 and to a far lesser extend CFC-115. Main application is domestic refrigerators, followed by commercial and industrial refrigeration.

3. ENTERPRISE BACKGROUND

SANDEN was founded in 1990. The company is 70% locally and 30% Japanese owned. It manufactures commercial refrigerators and freezers for the storage and display of beer, soft drinks and ice cream. About 300 people generated in 1993 sales of more than 10 million US dollar. The company operates currently a two component low pressure 60 kg/min output foam dispensing unit. CFC-11 is purchased separately and pre-mixed in the polyol component. The company operates one filling unit for refrigerant.

The refrigeration sector enjoys in Thailand very rapid growth related to the general economic situation as well as to the tourist industry. Production growth of SANDEN in the last years reflect this:

PRODUCTION	1992	1993	1994(1-3)	1994(forecast)
UNITS	22,000	30,000	12,000	55,000
CFC-11 USE	11,000	15,000	5,000	24,000
CFC-12 USE	5,500	7,500	2,500	12,000

Figures used throughout the document are based on 3/4th of 1993 production plus first quarter of 1994 (in other words covering April 93 through March 94), or 34,500 units.

4. PROJECT DESCRIPTION

During the period April 93 - March 94, SANDEN used 13.25t CFC-11 in the manufacture of rigid PUF and 7.75t CFC-12 as a refrigerant for the cooling circuit. This is forecasted to increase to 24/12t in 1994. The company intends to replace these ODS as soon as feasible and has done quite some preparatory work including visits to German factories that employ cyclopentane technology for foam production.

A combination of reduced ABA (auxiliary blowing agent) technology and cyclopentane is considered as the replacement of choice for its foam production operation. As refrigerant, HFC-134a is selected. Existing low pressure foam dispensing equipment (one unit) has to be replaced by a high pressure one; a pre-blending unit will have to be installed in conjunction with a secure storage area. Additional safety measures to cope with flammable substances are also included in the project. The use of HFCs requires retrofitting and partial replacement of vacuum pumps and replacement of the charging equipment. Additional cost for trials and training will occur. In addition to equipment changes, recurrent incremental operating cost are expected, related to higher isocyanate use, different compressors and the use of HFC-134a.

5. TECHNOLOGY

5.1 OVERVIEW AND SELECTION

There are several options to replace CFCs in the production of rigid polyurethane insulation foam, such as:

- CFC-11 > partial water/HCFC-141b > ?
- CFC-11 > partial water/HCFC-22 > HFC-134a, 152a
- CFC-11 > partial water/(cyclo)pentane

The first solution--also called the "liquid" solution--employs technology that is closely related to the existing. The final step in this process is not yet decided. One potential solution is HFC-356, but full water blown foam with improved skin formation remains an option, specifically in "lesser demanding" systems.

The second one--also called the "gas" solution--utilizes a gaseous mixture of physical blowing agents, requires high pressure equipment, and extensive process adjustments. The final step in this process is seen as the introduction of (gaseous) HFCs. The high diffusion rate of HCFC-22 limits its use to encapsulated systems.

Pentane technology is lately commercially introduced on several

occasions. Its flammable character requires safety conditions and limits its use to enterprises that can cope which such substances. Cyclopentane is also regionally restricted in availability, but this changes quickly.

A combination of water-blown (= reduced ABA) technology and the use of cyclopentane is identified by the company as an alternative that is:

- o Proven technology in processing and product performance,
- o Environmentally acceptable,
- o Available from sources in the USA and Europe through bulk storage in Singapore.

The company has an excellent safety record and it is expected that it can easily cope with the safety aspect of cyclopentane.

HFC-134a is currently virtually unchallenged as replacement technology for CFC-12 in refrigeration.

5.2 IMPACT ON PRODUCTION PROCESS

The use of cyclopentane technology will be facilitated through the employment of high pressure foam production equipment. Cyclopentane is highly flammable. For the intended purpose, the following should be considered:

- Storage tank
  - Separate, explosion proof storage of the cyclopentane
- Equipment
  - new high pressure foaming machine
  - pre-blender for CP
  - new charging systems
  - new or retrofitted vacuum pumps
  - new gas and leak detector
- Production
  - reconstruction of the production area for the new process
  - modification of foaming moulds
  - grounded electrical systems
  - explosion proof motors and switches
  - sealing of electrical control cabinets.
- Auxiliary safety devices
  - upgraded ventilation system
  - fire protection system in foaming area
  - extra fire extinguishers

Production and maintenance personnel is to be trained in the safe handling of hydro-carbons, in addition to production training. Start-up trials are to be made to adjust for the different foaming volume and permeability.

6. PROJECT COSTS

6.1 CAPITAL COSTS

The following is a summary of the expected costs (in USD) of investment and related activities:

DESCRIPTION	SUBTOTAL	TOTAL
Equipment		
High pressure machine, premix unit and supply pumps	260,000	
Transfer system for mixing head	40,000	
Pre-heating oven	10,000	
Charging and vacuum system	35,000	
Storage tank and piping for pentane	40,000	
Ventilation for jigs and machine	20,000	
Gas detectors	15,000	
Leak detectors	10,000	430,000
Modifications		
Modification of 8 jigs	20,000	
Electrical modifications	20,000	
Misc. fire protection	15,000	
Production trials	25,000	80,000
Other Cost		
Technology transfer	25,000	
Process/safety training	10,000	
Pre/post safety audit	10,000	
Outside testing	16,000	
Contingency/rounding	59,000	120,000
TOTAL INCREMENTAL CAPITAL COST		**630,000**

6.2 OPERATING COSTS

The company will experience higher cost for the refrigerator circuit. The foam production cost will be essential unchanged. The net present value of these cost over a period of two years at 10% discount amount to (see annex A):

USD 253,100

6.3 UNIT ABATEMENT COST

a)	ODS Reduction Project Costs	USD 630,000
b)	Annual Incremental Costs (base 1995)	USD 145,878
c)	Project Useful Costs	10 Years
d)	ODS Reduction/Year	kg 21,000
f)	Capital Recovery factor (10% discount)	0.16275
	Unit Abatement Costs [{a(f) + b)/d]	**USD/kg/y 11.83**

7. FINANCING PLAN

The company requests the reimbursement of 70% of the project costs, reflecting the local ownership calculated on

USD 618,200

8. PROJECT IMPLEMENTATION

8.3 SCHEDULE

TASK	TIME FOR COMPLETION					
	Q1	Q2	Q3	Q4	Q5	Q6
1. Preparation						
MLF Approval	x					
Pre Audit	x					
Order Confirmation(s)	x					
2. Installation						
Arrival, Customs			x			
Installation			x			
3. Start-up, Training						
Machine Start-up				x		
Trials/Training				xxx		
4. Post Audit/Commissioning				x		

8.1 MANAGEMENT

UNDP will oversee the completion of this project.

8.2 PROCUREMENT

UNDP will oversee the procurement and provide technical and procedural assistance.

9. PROJECT IMPACT

This project will eliminate the use of at least 30 tons of CFCs in the first year of implementation. The project employs commercially and environmentally acceptable technology.

10. ANNEXES

Annex A: Detailed calculation of incremental recurrent cost
Annex B: Technical Review

ANNEX-A
INCREMENTAL RECURRENT COSTS

The use of all water/Cyclopentane blown foam triggers price consequences, related to the use of a different foam formulation as well as different chemicals.

The use of HFC-134a as refrigerant triggers price consequences based on higher cost of the refrigerant as well as mechanical /electrical parts.

1. ASSUMPTIONS

- CFC-11 price - USD 2.10/kg
  CFC-12 price - USD 3.00/kg
  Cyclopentane price - USD 2.20/kg
  MDI price - USD 2.20/kg[1]

- 1 part CFC-11 replaced by water/CO_2 equals 1.5 parts of MDI;
  1 part of CFC-11 equals 0.7 parts of Cyclopentane;
  1 part of CFC-12 equals 0.90 parts of HFC-134a.

2. MATERIAL COST

BLOWING AGENT

Before:	17.25t CFC-11 @ USD 2,100	USD (36,225)
After:	13.23t MDI @ USD 2,200	USD 29,095
	6.04t Cyclopentane @ USD 2,200	USD 13,283
	Additional material Costs/y	**USD 6,153**

REFRIGERANT

Before:	8.63t CFC-12 @ USD 3,000	USD (25,875)
After:	7.76t HFC-134a @ USD 8,000	USD 62,100
	Higher cost of compressor, drier, capillary: 34,500 @ USD 3.00	USD 103,500
	Additional material cost/y	USD 139,725
	TOTAL INCREMENTAL RECURRENT COST	**USD 145,878**

This amounts at a discount rate of 10% over two years of operation to a Net Present Value (NPV) of

USD 253,100

[1] Chemical prices are based on local prices, excluding taxes/duties or on interregional prices plus 20%, whatever is lower (following a pertinent ExCom decision.

END

TECHNICAL REVIEW

PREPARED BY: Bert Veenendaal
UNDP Foam Sector Expert

DATE: June 13, 1994

1. COUNTRY OF ORIGIN:	THAILAND
2. PROJECT TITLE:	SANDEN elimination of the use of CFCs in the manufacture of commercial refrigerators
3. (SUB)SECTOR	Foams/Refrigerants
4. CP RELATIONSHIP:	Not Known
5. TECHNOLOGY:	The choice of technology of the company is the use of Cyclopentane as a blowing agent and of HFC-134a as a refrigerant. Both choices are supported. Cyclopentane constitutes a "permanent" replacement technology. The company is sufficiently safety conscious to allow the employment of a flammable substance. Cyclopentane operating cost are practically matching those of CFC-11 in Thailand. The choice of HFC-134a as refrigerant is currently generally accepted as the best available technology. There are considerable incremental recurrent cost (IRC) involved in the use of HFC-134a
6. ENVIRONMENTAL IMPACT:	Cyclopentane is highly flammable. The company is aware of this and capable to cope with the need to provide the necessary safety through equipment and operation. The compound has no ODP and a low GWP. HFC-134a has no ODP but a significant GWP--although much lower than CFC-12
7. PROJECT COSTS:	The unit abatement cost are in comparison high (USD 12.78 compared with Lian Pang/Malaysia 0.84 and Unimagna/Philippines 8.65). One explanation is the icebox activity at Unimagna (no refrigerant involved) and

the participation in the equipment cost from Lian Pang. However, Sanden tends to select the very best and expensive equipment. While it is up to the company to select the best equipment, the Fund should not have to pay more than what is needed to "get the job done". An example of reasonable cost development is Unimagna/Philippines. On the other side, it would be unfair to apply Unimagna's cost to Sanden as the company has now already a more sophisticated operation (more vacuum pumps, an excellent, albeit low pressure foaming unit etc.). It is suggested to implement both projects coordinated and cross-check cost information.

A special case is the incremental recurrent cost related to the refrigeration circuit. Sanden wants to use a "dry" system. This, in combination with high compressor and HFC cost leads to a claim of over USD 13.00/unit RICs. Unimagna claims only about one third. it is recommended to grant Sanden RIC based on Unimagna's information and to allow the company to apply this to its own solution

8. **IMPLEMENTATION:** Adequate

9. **RECOMMENDATION:** The project is recommended for approval with the stipulation of coordinated implementation with Unimagna

PROJECT COVER SHEET

COUNTRY:	THAILAND
PROJECT TITLE:	**LUCKY GROUP** - Elimination of the use of CFCs in the manufacture of flexible polyurethane foam (slabstock)
SECTOR COVERED:	Foamed Plastics
ODS USE IN SECTOR:	1510t CFCs (=ODP) in 1991
PROJECT IMPACT:	187 tons (base 1993)
PROJECT DURATION:	One year
PROJECT ECONOMIC LIFE:	10 Years
TOTAL PROJECT COSTS:	USD 605,000 Incremental Capital Cost
PROPOSED MLF GRANT:	USD 605,000
COST EFFECTIVENESS:	USD 0.53 /kg/y (unit abatement cost)
NATIONAL COORDINATING BODY:	Department of Industrial Works (DIW), Ministry of Industry
IMPLEMENTING AGENCY:	UNDP
APPRAISAL DATE:	April 20/June 8,1994

PROJECT SUMMARY

Lucky Group is a 100% Thai-owned enterprise comprising four foam companies: Eastern Foam Products, Luck Foam, Southern Foam and Thai Development Foam. Lucky Group manufactures flexible polyurethane foam (slabstock) for mattresses, cushions and other foam products for the bedding/furniture industry. The Group consumed, in 1993, 187 MT of CFC-11 as blowing agent. Under the project, the Group will eliminate CFCs by switching to the use of methylene chloride and vacuum-cooling systems. Improved ventillation and fire protection systems will be installed. An external process expert will be recruited to provide safety and production training.

Prepared by: Mr. Tommy Lauridsen, Foam Consultant
Reviewed by: Mr. Bert Veenendaal, UNDP Sector Expert (Foams)

PROJECT OF THE GOVERNMENT OF THE THAILAND

LUCKY - ELIMINATION OF THE USE OF CFCs IN THE MANUFACTURE OF FLEXIBLE POLYURETHANE FOAM (SLABSTOCK)

1. PROJECT OBJECTIVE

The objective of this project is to phaseout the use of CFCs in the manufacture of flexible polyurethane foam (slabstock) at the Lucky Group in Bangkok, Thailand.

2. SECTOR BACKGROUND

ODS are used as blowing agents in the production of five types of foams in Thailand--appliance insulation, flexible foams, rigid construction insulating foams, polystyrene packaging and miscellaneous applications. Producers of foam products in Thailand used almost 1,600t of ODS in 1991, primarily CFC-11 and to a lesser extend CFC-12.

The refrigeration sector consumed in the same period almost 1,000t CFCs, predominantly CFC-12 and to a far lesser extend CFC-115. Main application is domestic refrigerators, followed by commercial and industrial refrigeration.

3. ENTERPRISE BACKGROUND

Lucky Group is a 100% Thai-owned enterprise comprising four foam companies: Eastern Foam Products, Luck Foam, Southern Foam and Thai Development Foam. Lucky Group manufactures flexible polyurethane foam (slabstock) for mattresses, cushions (???) and other foam products for the bedding/furniture industry. The Group has four continuous foaming lines.

4. PROJECT DESCRIPTION

Lucky Group utilized 187 MT of CFC-11 in 1993. The Group has decided to phaseout the use of CFC-11 by means of methylene chloride coupled with vacuum-cooling system. Both are commonly available technologies. For the use of methylene chloride, modifications on existing foaming equipment and the metering system will be necessary, together with safety improvement in the production area to reduce exposure hazards.
Methylene chloride is not suitable as a sole replacement for the very low density foams that are produced in the Thai market. The resulting scorching has a detrimental effect on the foam quality and constitutes an unacceptable fire risk. Also, the very high amount of methylene chloride that would be required in such formulations would cause problems in processing. It is therefore intended to complete the conversion with a vacuum-cooling system that will allow a partial conversion to water-blown formulations.

An international process expert will be recruited to provide technical expertise with regard to formulation adjustments, safety and production training and to support the company during the conversion period.

5. TECHNOLOGY

5.1 OVERVIEW

There are numerous technologies to replace the use of CFCs in flexible foam by non ODS or low ODS options. The use of methylene chloride constitutes the most economic and an environmentally acceptable solution, provided there are adequate safeguards in the production process and production chambers. However, methylene chloride does not perform well in extreme low densities.

5.2 SELECTION AND PRODUCTION PROCESS

Management of Lucky Group decided to opt for the use of a combination of an alternative blowing agent--methylene chloride--and increased water levels, resulting in more chemically generated CO_2. The increased process heat will be removed by a vacuum cooling system.

The combination of these technologies will allow replacement of CFCs in a cost-effective way, without unacceptable losses in performance and processing. 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, workplace concentrations of methylene chloride have to be limited to acceptable industrial hygienic standards.

The modifications needed to implement the use of methylene chloride as a blowing agent include:

- Encapsulation, ventilation,
- Reformulation.

A water sprinkler system will have to be installed in the foam tunnel and is highly recommended in the entire process area. Interlocking devices between ventilation and the sprinkler system are also recommended. Safety and process training for production staff and personnel will be required.

The vacuum cooling system will require back-up power (already available) to avoid fire risks related to power outings. Again, extensive operating and safety awareness training.

6. PROJECT COSTS

6.1 TOTAL PROJECT COSTS

Additional metering systems (3x$30,000)	US$90,000
Additional additive systems (3x$10,000)	30,000
Fast-cure machine (1 unit)	190,000
Improved exhaust/ventilation systems (3x$40,000)	120,000
Safety devices (water lance:3x$10,000)	30,000
Technology Transfer	25,000
Training	10,000
Trial Materials	50,000
Safety Audit	5,000
Contingency & rounding	55,000
TOTAL CAPITAL COSTS	**US$ 605,000**

6.2 OPERATING COSTS

The use of methylene chloride will lower the production cost; however, with the introduction of methylene chloride into the formulation, the quality of the foam will suffer. To compensate for the lower quality, it is necessary to increase the density of the foam somewhat or to accept--at least initially--higher yield losses. Common praxis is that on the long term companies learn to cope with the more complicated processing of methylene chloride and are able to gain some profits. Annex-A provides more details.

6.3 UNIT ABATEMENT COSTS

a) Capital Costs	USD 605,000
b) Lifetime of the Investment	10 years
c) Incremental recurrent Costs	-
d) CFC Consumption in 1993	kg 187,000
e) Capital recovery factor (10% discount)	0.16275
UNIT ABATEMENT COSTS [a(e)+b/d]	**US$ 0.53 kg/yr**

7. FINANCING PLAN

The Company requests a grant in the amount of the incremental capital costs. This amounts to

USD 605,000.

8. PROJECT IMPLEMENTATION

8.1 MANAGEMENT

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

8.2 PROCUREMENT

UNDP will oversee the procurement and provide technical assistance.

8.3 SCHEDULE

Implementation schedule will start with MLF approval of the project and will end after monitoring has confirmed that no unsafe level of exposure exist in the working area or on the machine.

TASK	TIME FOR COMPLETION					
	Q1	Q2	Q3	Q4	Q5	Q6
1. Preparation						
MLF Approval	x					
Pre Audit	x					
Order Confirmation(s)	x					
2. Installation						
Arrival, Customs			x			
Installation			x			
3. Start-up, Training						
Machine Start-up				x		
Trials/Training				xxx		
4. Post Audit/Commissioning				x		

9. PROJECT IMPACT

This project will eliminate the use of at least 187 tons of CFCs in the first year of implementation. The project employs commercially and environmentally acceptable technology.

Annex A: Recurrent Incremental Cost
Annex-B: Technical Assessment

..\THALUCKY.PRD
94-06-10

ANNEX - A

RECURRENT INCREMENTAL COSTS

For conversion from CFC-11 to methylene chloride, it is generally assumed a drop of about 5% net in prime yield during the first year, and 2.5% during the second year. After that, yield figures normally return to standard.

In the process, 187 tons/year of ODS is replaced by an equal tonnage of methylene chloride. In addition, the catalysts and polyol have to be changed, recurrent safety training, operating costs for the forced cooling and increased maintenance will be needed. This will impact on the operating costs as follows:

ITEM	BEFORE	AFTER
187 T/Y CFC-11 @ US$ 2.1/kg	USD 392,700	
187 T/Y Methylene Chloride @ US$ 0.7 /kg		USD 130,900
10 T/Y Softening Additive @ 7.50/kg		75,000
3 T/Y Extra Amine Catalyst @ 15.00/kg		45,000
3 T/Y Extra Tin Catalyst @ 8.00/kg		24,000
? T/Y BHT free polyol @		pm
Annual electricity for forced cooling		20,000
Training, Maintenance		USD 20,000
TOTAL	**USD 392,700**	**USD 314,900**
DIFFERENCE		**USD 77,800**

INCURRED COSTS FROM PRIOR CONVERSION EFFORTS:

First year yield:

Incremental Gain = USD 77,800
Loss = 5% x 2500 T/Y @1550 = 193,750
- 115,950 x 1.0000 = USD -115,950

Second year yield:

Incremental Gain = USD 77,800
Loss = 2.5% x 2500 T/Y @ 1550 = - 96,875
- 19,075 x 0.9090 = USD - 17,339

Third year yield:

Incremental Gain = USD 77,800
Loss = 0% x 2500 T/Y @ 1550 = - 0
+ 77,800 x 0.8260 = USD + 64,263

Fourth year yield:

Incremental Gain = USD 77,800
Loss = 0% x 2500 T/Y @ 1550 = - 0
+ 77,800 x 0.7513 = USD + 58,489

NET FOUR YEAR TOTAL.....USD -10,537

On the balance, a slight increase in incremental recurrent costs appears to exist over the 4 year transitional period. However, it is acknowledged that subsequent years would turn the balance . Based on this, recurrent incremental costs should not be considered.

TECHNICAL REVIEW

PREPARED BY: Bert Veenendaal
UNDP Foam Sector Expert

DATE: June 13, 1994

1. COUNTRY OF ORIGIN: THAILAND

2. PROJECT TITLE: LUCKY GROUP elimination of the use of CFCs in the manufacture of flexible polyurethane foam (slabstock)

3. (SUB)SECTOR: Foamed Plastics

4. CP RELATIONSHIP: Not Known

5. TECHNOLOGY: The choice of technology of the company is the use of methylene chloride (MC) as a blowing agent. This is accepted technology that is predominantly applied in North America, but also to a lesser extend in some European countries and in Japan. It is cost-effective, but requires a long learning curve for the recipients--sometimes several years. Many companies start to apply this technology without MLF funds, but revert later entirely or partly because of process problems. Also, workers safety is very often compromised by not providing adequate ventilation or fire safety

In the low densities complementation with fast cure technology, to avoid scorching, is necessary. Because of the fact that the company has four foaming units it is possible to rearrange the production program in such a way that the low densities are concentrated on one unit and to save cost

6. ENVIRONMENTAL IMPACT: MC has a relative short retention time in the atmosphere. Its contribution to ozone depletion and to global warming is consequently negligible. The problem with this substance is its perceived toxicity. Although MC is only classified as a suspected human carcinogen and even this classification

	is contested, measures to ensure proper worker protection to avoid exposure above acceptable standards (about 50 ppm TWA in most industrialized countries) should be part of any MLF project involving MC. This project addresses this problem adequately.
7. PROJECT COSTS:	The unit abatement cost are reasonable for this type of operation (0.53 versus generally 0.50 - 1.50). There is no detailed calculation of IRCs. However, the conclusion is supported through several projects from Egypt, Ghana. Indonesia and Malaysia
8. IMPLEMENTATION:	Adequate
9. RECOMMENDATION:	The project is recommended for approval

LUCKY GROUP

TOTAL USAGE F-11

JANUARY - DECEMBER 1993

MONTH	USAGE (kgs.)
JANUARY	10,148.72
FEBRUARY	7,027.00
MARCH	6,182.00
APRIL	13,914.00
MAY	16,116.50
JUNE	18,973.00
JULY	21,607.29
AUGUST	16,758.60
SEPTEMBER	15,811.00
OCTOBER	19,534.00
NOVEMBER	22,109.00
DECEMBER	19,363.00
TOTAL	187,544.11
AVERAGE PER MONTH	15,628.68